U.S. Department of Energy
Office of River Protection
P.O. Box 450
Richland, Washington 99352

04-WTP-167

Mr. J. P. Henschel, Project Director
Bechtel National, Inc.
2435 Stevens Center
Richland, Washington 99352

Dear Mr. Henschel:

CONTRACT NO. DE-AC27-01RV14136 – SAFETY EVALUATION REPORT (SER) OF THE ANALYTICAL LABORATORY CONSTRUCTION AUTHORIZATION REQUEST (CAR)

Reference: BNI letter from J. P. Henschel to R. J. Schepens, ORP, "Request for Review and Approval of the Construction Authorization Request for the Hanford Waste Treatment and Immobilization Plant - Analytical Laboratory Facility," CCN: 087896, dated June 2, 2004.

This letter forwards the U.S. Department of Energy, Office of River Protection (ORP) SER, Revision 0 (Attachment) for the Bechtel National, Inc. (BNI) CAR submitted in the Reference letter. The SER documents the results of the ORP safety review of the preliminary design of the Waste Treatment and Immobilization Plant analytical laboratory. The results of the SER support issuance of a construction authorization agreement with conditions for construction of the analytical laboratory. The Conditions of Acceptance, as summarized in Appendix B of the SER, will be included in the Construction Authorization Agreement to be forwarded to BNI by separate correspondence.

Review of the analytical laboratory CAR was conducted based on a variety of calculations and reports, some of which were preliminary, as denoted by an alpha-revision number on the document (e.g., Revision A, B, etc.) as listed in Section 6.0, References, of the SER. These calculations and reports may be part of the approved authorization basis. As such and depending on the scope of the change, changes to such calculations and reports may require an authorization basis change to be made when the calculations and reports are issued for construction. Any changes must use the criteria in RL/REG-97-13, Revision 11, *Office of River Protection Position on Contractor-Initiated Changes to the Authorization Basis.*

If you have any questions, please contact me, or your staff may call Lewis F. Miller, Jr., WTP Safety Authorization Basis Team, (509) 376-6817.

Sincerely,

Roy J. Schepens
Manager

WTP:REL

ORP/WTP-2004-02
Revision 0

SAFETY EVALUATION REPORT FOR WASTE TREATMENT AND IMMOBILIZATION PLANT (WTP) ANALYTICAL LABORATORY CONSTRUCTION AUTHORIZATION

July 29, 2004

U.S. Department of Energy
Office of River Protection
P.O. Box 450, H6-60
Richland, Washington 99352

ORP/WTP-2004-02
Revision 0

SAFETY EVALUATION REPORT FOR WASTE TREATMENT AND IMMOBILIZATION PLANT (WTP) ANALYTICAL LABORATORY CONSTRUCTION AUTHORIZATION

July 29, 2004

U.S. Department of Energy
Office of River Protection
P.O. Box 450, H6-60
Richland, Washington 99352

Approved: ______________________________
Roy J. Schepens, Manager

Date: __________________________________

PREFACE

As directed by Congress in Section 3139 of the *Strom Thurmond National Defense Authorization Act for Fiscal Year 1999,* the U.S. Department of Energy (DOE) established the Office of River Protection (ORP) at the Hanford Site to manage the River Protection Project (RPP), formerly known as the Tank Waste Remediation System. ORP is responsible for the safe storage, retrieval, treatment, and disposal of the high level nuclear waste stored in the 177 underground tanks at Hanford.

The initial concept for treatment and disposal of the high level wastes at Hanford was to use private industry to design, construct, and operate a Waste Treatment and Immobilization Plant (WTP) to process the waste. The concept was for DOE to enter into a fixed-price contract for the Contractor to build and operate a facility to treat the waste according to DOE specifications. In 1996, DOE selected two contractors to begin design of a WTP to accomplish this mission. In 1998, one of the contractors was eliminated, and design of the WTP was continued. However, in May 2000, DOE chose to terminate the privatization contract and seek new bidders under a different contract strategy. In December 2000, a team led by Bechtel National, Inc. was selected to continue design of the WTP and to subsequently build and commission the WTP.

On January 10, 2001, the U.S. Department of Energy published the revised Nuclear Safety Management rule, 10 CFR 830. This rule, in Subpart B, "Safety Basis Requirements," established specific requirements for the establishment and maintenance of the safety basis of DOE nuclear facilities, including the WTP project.

A key element of the WTP is DOE regulation of safety. The mission of removal and immobilization of the existing large quantities of tank waste by the WTP Contractor must be accomplished safely, effectively, and efficiently.

The DOE principles of integrated safety management were built into the regulatory program for design, construction, operation, and deactivation of the facility. The regulatory program for nuclear safety permits waste treatment services to occur on a timely, predictable, and stable basis, with attention to safety.

A key feature of this regulatory process is its definition of how the standards-based integrated safety management principles are implemented to develop a necessary and sufficient set of standards and requirements for the design, construction, operation, and deactivation of the WTP facility. This process meets the expectations of the DOE necessary and sufficient closure process (subsequently renamed Work Smart Standards process) in DOE Policy 450.3, *Authorizing Use of the Necessary and Sufficient Process for Standards-based Environment, Safety and Health Management*, and is intended to be a DOE approved process under DOE Acquisition Regulations, DEAR 970.5204-2, *Laws, Regulations and DOE Directives,* Section (c). DOE approval of the contractor-derived standards is assigned to the Manager, ORP.

The WTP Contractor has direct responsibility for WTP safety. DOE requires the Contractor to integrate safety into work planning and execution. This integrated safety management process emphasizes that the Contractor's direct responsibility for ensuring that safety is an integral part of mission accomplishment. DOE, through its safety regulation and management program, verifies that the Contractor achieves adequate safety by complying with approved safety requirements.

RECORD OF REVISION

Document Title: Safety Evaluation Report for Waste Treatment and Immobilization Plant (WTP) Analytical Laboratory Construction Authorization

Document Number: ORP/WTP-2004-02

Revision Date	**Revision Number**	**Reason for Revision**
07/29/04	0	New Issue

EXECUTIVE SUMMARY

This report summarizes the safety evaluation performed on the Waste Treatment and Immobilization Plant (WTP) Analytical Laboratory Preliminary Safety Analysis Report (PSAR) submitted by Bechtel National, Inc. (BNI), to the U.S. Department of Energy's Office of River Protection (ORP). This safety evaluation report (SER) covers the review and approval of the following document:

- 24590-WTP-PSAR-ESH-01-002-06, *Preliminary Safety Analysis Report to Support Construction Authorization; Lab Facility Specific Information,* Rev. C, June 2, 2004.

BNI previously submitted Volumes I through V of the PSAR covering general information, pretreatment, low-activity waste, high-level waste, and the balance of facility to ORP for review and approval. The annual updates to all five volumes were resubmitted on September 30, 2003, and approved by ORP on January 29, 2004. The currently approved PSARs are as follows:

- 24590-WTP-PSAR-ESH-01-002-01, *Preliminary Safety Analysis Report to Support Construction Authorization; General Information*, Rev. 1, September 30, 2003;

- 24590-WTP-PSAR-ESH-01-002-02, *Preliminary Safety Analysis Report to Support Construction Authorization: PT Facility Specific Information*, Rev. 1, September 30, 2003;

- 24590-WTP-PSAR-ESH-01-002-03, *Preliminary Safety Analysis Report to Support Construction Authorization; LAW Facility Specific Information*, Rev. 1, September 30, 2003;

- 24590-WTP-PSAR-ESH-01-002-04, *Preliminary Safety Analysis Report to Support Construction Authorization: HLW Facility Specific Information*, Rev. 1, September 30, 2003; and

- 24590-WTP-PSAR-ESH-01-002-05, *Preliminary Safety Analysis Report to Support Construction Authorization: Balance of Facility Specific Information*, Rev. 1, September 30, 2003.

Review of the analytical laboratory PSAR identified 13 conditions of acceptance, as listed in Appendix B of this SER. The analytical laboratory PSAR is approved subject to the Contractor completing these conditions of acceptance by the date or milestone listed for the condition.

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List of Appendixes

SAFETY EVALUATION REPORT FOR WASTE TREATMENT AND IMMOBILIZATION PLANT (WTP) ANALYTICAL LABORATORY CONSTRUCTION AUTHORIZATION

1.0 INTRODUCTION

This document summarizes the safety evaluation performed by the U.S. Department of Energy (DOE), Office of River Protection (ORP), of the Waste Treatment and Immobilization Plant (WTP) Analytical Laboratory Preliminary Safety Analysis Report (PSAR) submitted by Bechtel National, Inc. (BNI), (the Contractor) for the River Protection Project (RPP). The analytical laboratory PSAR consisted of the following document:

- 24590-WTP-PSAR-ESH-01-002-06, *Preliminary Safety Analysis Report to Support Construction Authorization; Lab Facility Specific Information*, Rev. C, June 2, 2004.

Other parts of the WTP PSAR were sequentially submitted in the following five volumes to ORP for review and approval between November 2001 and May 2002 as part of the Construction Authorization Request (CAR):

- 24590-WTP-PSAR-ESH-01-002-01, *Preliminary Safety Analysis Report to Support Construction Authorization; General Information*, Rev. E, November 9, 2001

- 24590-WTP-PSAR-ESH-01-002-02, *Preliminary Safety Analysis Report to Support Construction Authorization: PT Facility Specific Information*, Rev. E, May 1, 2002

- 24590-WTP-PSAR-ESH-01-002-03, *Preliminary Safety Analysis Report to Support Construction Authorization; LAW Facility Specific Information*, Rev. F, January 31, 2002

- 24590-WTP-PSAR-ESH-01-002-04, *Preliminary Safety Analysis Report to Support Construction Authorization: HLW Facility Specific Information*, Rev. H, February 19, 2002

- 24590-WTP-PSAR-ESH-01-002-05, *Preliminary Safety Analysis Report to Support Construction Authorization: Balance of Facility Specific Information*, Rev. F, February 19, 2002.

ORP issued a final, comprehensive safety evaluation report (SER) in March 2003, conditionally approving the PSARs.[1] A separate Construction Authorization Agreement authorizing full facility construction for the pretreatment (PT), low-activity waste (LAW), high-level waste (HLW), and portions of the balance of facility (BOF) was issued to the Contractor in

[1] ORP/OSR-2002-18, *Safety Evaluation Report for Waste Treatment and Immobilization Plant (WTP) Construction Authorization*.

March 2003.[2] The Construction Authorization Agreement listed the conditions of acceptance (COAs) for each volume of the PSAR. An annual update of the first five volumes of the PSAR was submitted to ORP for review and approval on September 30, 2003.[3] ORP issued an SER approving the PSAR update with COAs on January 29, 2004.[4]

A structured process was used to review each segment of the analytical laboratory PSAR based on RL/REG-99-05, *Review Guidance for the Construction Authorization Request (CAR).* The report was issued in July 2001 to provide guidance for the Contractor in developing the content of its PSAR submittals and for reviewers in evaluating the PSAR.[5] While the content of the Contractor's CAR was based on RL/REG-99-05, the format of the PSAR was based on DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports.*[6]

The review process provided for written questions to the Contractor to elicit explanatory information on the analytical laboratory PSAR. Extensive discussions and electronic mail messages were used between ORP and the Contractor to enable the Contractor to revise draft responses to these questions and arrive at acceptable, final responses.

2.0 REVIEW PROCESS

The analytical laboratory PSAR submittal was reviewed using the approval criteria outlined in RL/REG-99-05. The submittal was reviewed to ensure that the proposed construction activities would provide for adequate safety of the workers and the public by (1) applying the integrated safety management (ISM) process, which includes following the contractually prescribed process for requirements' and standards' identification and selection; (2) complying with applicable laws and regulations; and (3) conforming to DOE-stipulated top-level safety standards and principles. In addition, the review confirmed that the criteria of DOE O 420.1A, *Facility Safety*, applicable to the analytical laboratory, had been applied as required by 10 CFR 830.206(b), "Preliminary documented safety analysis."

For the ORP Manager to authorize construction of the analytical laboratory, the reviewers first had to determine that the following criteria were met:[7]

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[2] ORP/OSR-2003-01, *Construction Authorization Agreement Between the U. S. Department of Energy Office of River Protection and Bechtel National, Inc.*

[3] CCN: 067261, BNI letter from J. P. Henschel to R. J. Schepens, ORP, "Contract No. DE-AC27-01RV14136 - 2003 Preliminary Safety Analysis Report Update," dated September 30, 2003.

[4] ORP/OSR-2003-22, *Safety Evaluation Report for Waste Treatment and Immobilization Plant (WTP) Preliminary Safety Analysis Report (PSAR) Update*.

[5] While the OSR provided guidance, alternative descriptions also were acceptable if they were adequately justified.

[6] 01-OSR-0483, ORP letter from R. J. Barr to R. F. Naventi, BNI, "Partial Approval of Bechtel National, Inc. (BNI) Authorization Basis Change Notice, ABCN-24590-01-00004, Rev. 1," dated December 5, 2001.

[7] DOE/RL-96-0003, *DOE Process for Radiological, Nuclear, and Process Safety Authorization, Verification, and Confirmation of the RPP Waste Treatment Plant Contractor*, Section 3.3.3, "Authorization for Construction."

- The proposed important-to-safety (ITS)[8] features were being implemented according to the approved Safety Requirements Document (SRD).

- Proposed changes to the SRD and the Integrated Safety Management Plan (ISMP) were acceptable.

- The design complied with the design-related sections of the updated SRD.

- The design properly accounted for the natural and manmade external events associated with the designated site.

- The Contractor was qualified by experience and training to perform the proposed construction.

- The construction procedures were adequate to ensure that the construction-related part of the SRD would be properly implemented.

- The quality assurance (QA) plan was adequate and had been implemented such that the intended quality would be ensured in the ITS portions of construction and that the QA records would attest to that assurance.

- The Contractor had committed to comply with the conditions of the Authorization Agreement associated with the construction activities.

Internal and external experts were used to review the safety documentation submitted by the Contractor. Appendix A lists the reviewers who were involved in reviewing the analytical laboratory submittals.

[8] ITS refers to structures, systems, and components (SSCs) that reasonably ensure that the facility can be operated without undue risk to the health and safety of the workers and the public. It encompasses the broad class of facility features addressed (not necessarily explicitly) in the top-level radiological, nuclear, and process safety standards and principles that contribute to the safe operation and protection of workers and the public during all phases and aspects of facility operations (i.e., normal operation as well as accident mitigation). This definition includes not only SSCs that perform safety functions and traditionally have been classified as safety class, safety-related, or safety grade, but also those that place frequent demands on or adversely affect the performance of safety functions if they fail or malfunction, i.e., support systems, subsystems, or components. Therefore, these latter SSCs would be subject to applicable top-level radiological, nuclear, and process safety standards and principles to a degree commensurate with their contribution to risk. In applying this definition, it is recognized that during the early stages of the design effort, all significant systems interactions may not be identified and only the traditional interpretation of ITS, i.e., safety-related, may be practical. However, as the design matures and results from risk assessments identify vulnerabilities resulting from non-safety-related equipment, additional SSCs should be considered for inclusion within this definition.

3.0 EVALUATION - ANALYTICAL LABORATORY

This section describes the review that was performed on Volume VI of the PSAR:

- 24590-WTP-PSAR-ESH-01-002-06, *Preliminary Safety Analysis Report to Support Construction Authorization: Lab Facility Specific Information*, Rev. C, June 2, 2004.

The scope of analytical laboratory activities covered in the PSAR was the full construction of the analytical laboratory facility, systems, and processes.

3.1 Facility Description

The purpose of this review was to determine whether the PSAR acceptably described the analytical laboratory facility and processes encompassed by the PSAR. This review addressed facility and process descriptions that could affect safety functions, hazards, or potential accidents (at the completed facility) and their consequences. Examples of facility features are location, facility design information, and the location and arrangement of buildings on the facility site. Examples of process features are the general arrangement, function, and operation of major components of the analytical laboratory processes.

3.1.1 Requirements

DOE/RL-96-0003, Section 4.3, "Authorization for Construction," contains the fundamental requirements for facility features, requiring the Contractor to describe the facility SSCs, including those designated as ITS. The Contractor's SRD contains additional applicable requirements. SRD Safety Criterion 4.1-2 addresses SSCs designated as ITS and requires that they be designed, fabricated, erected, constructed, tested, inspected, and maintained to quality standards commensurate with the ITS functions to be performed. Safety Criterion 4.1-3 addresses design of SSCs designated as ITS to withstand the effects of natural phenomena hazard (NPH) events such as earthquakes, wind, and floods without loss of capability to perform specified safety functions. The requirements for the facility and process descriptions are summarized separately below.

Facility Description – The facility description was acceptable if it was presented at a level of detail appropriate to support the portions of the PSAR relevant to construction of the analytical laboratory ITS facilities, if it identified and described the features that were ITS, and if it supported the hazard and accident analyses. For the analytical laboratory, the review included the following facility description elements: (1) facility location and distance to the nearest site boundary, (2) the layout and location of the analytical laboratory and other WTP buildings, (3) the analytical laboratory's ability to resist failures of ITS SSCs, (4) imposed design limits for quantifying the structural behavior of the concrete and steel structures, (5) design and analysis processes used for ITS structures, (6) ITS electrical systems and components, (7) ventilation and air cleaning systems and components, (8) effluent stacks, and (9) fire protection systems.

Process Description – DOE/RL-96-0003, Section 3.3.3, "Authorization for Construction," contains the process description requirements and requires the Contractor to design the facility to (1) comply with the design-related portion of the updated SRD and (2) properly account for the natural and man-made external events associated with the site. The process description was acceptable if it was presented at a level of detail appropriate to support the hazard and accident analyses and if it identified and described the ITS features. For the analytical laboratory, the review included the following process description elements: (1) a general description of the process, (2) the general arrangement of the major components of the process, (3) a discussion of process design, (4) the operating ranges and limits for process variables, (5) process equipment layout, (6) process design-related codes and standards, (7) instrumentation and controls required for monitoring the process, and (8) process systems for waste management.

3.1.2 Evaluation

The results of the reviewers' evaluation of the facility and process descriptions for the analytical laboratory are summarized separately below.

Facility Description – The reviewers found the facility location and design descriptions provided in PSAR Volume VI, Chapters 2, 3, and 4;[9] calculations; and other documents referenced in the PSAR acceptable subject to the Contractor completing the actions described below. The reviews found that the submittals acceptably met all of the criteria. The evaluation of the information for each review criterion is summarized below:

1. Information on the facility location was previously evaluated in ORP/OSR-2002-18, Section 3.2.2.1, "Evaluation," and was found to be acceptable.

2. The reviewers found the analytical laboratory's layout and location, as described in PSAR Volume VI, Section 2.3.2, "Building Description Summary," to be acceptable and at a level of detail consistent with the preliminary level of design.

3. The review focused on review of the structural design and on the ability of the structure to resist failures of ITS functions from credible internal and external events. The reviewers found the structural design, as discussed in PSAR Volume VI, Chapter 2, to be acceptable. Specific reviews were conducted to evaluate the Contractor's design approach for the analytical laboratory. The design method, as presented in the PSAR and referenced standards in document 24590-WTP-DC-ST-01-001, *Structural Design Criteria,* was reviewed and found acceptable. Reviewers concluded that the Contractor's implementation of these design methods and standards was done to a degree of rigor appropriate for the analytical laboratory and should result in an acceptable structural design. The following specific reviews and evaluations were conducted:

    (a) The reviewers found acceptable the choices and specific information pertaining to required codes and standards presented in Table 1 of document 24590-WTP-DC-

[9] Chapter 2, "Facility Description"; Chapter 3, "Hazard and Accident Analysis"; and Chapter 4, "Important to Safety Structures, Systems, and Components."

ST-01-001. These codes and standards met the requirements of SRD Safety Criteria 4.1-2 and 4.1-3.

(b) The reviewers found acceptable the NPH safety classification of the analytical laboratory to ensure its safety function without failure as seismic category (SC) SC-III for seismic events and performance category (PC) PC-2 for other external events. These designations were acceptable because they were consistent with SRD Safety Criterion 4.1-3 and with PSAR safety analyses discussed in Section 3.2 of this SER. No SC-I or SC-II SSCs were required per SRD Safety Criterion 4.1-3 because no safety class SSCs were identified for the analytical laboratory.

In response to PSAR question AL-PSAR-028 concerning the seismic classification of the in-cell monorail, hoists, solid waste handling system, and the auto sampling system, the Contractor stated that the hotcell monorail airlocks, which must maintain continuity of the confinement boundary, and the waste transfer port, which provides confinement, were classified as safety significant (SS) and designed to SC-III. The hotcell monorail itself was not ITS. The hoists, solid waste handling system, and the automated sampling system were also not ITS. No runway support beams or monorails performed a safety function. Failure of any of the non-ITS SSCs has no adverse impact on the existing design basis event (DBE) analyses because no credit was taken for their performance in the safety analysis. The reviewers found this clarifying response acceptable.

(c) The reviewers found the load factors and load combinations for the structural steel and concrete to be acceptable. Load combinations described in calculation 24590-LAB-S0C-S15T-00004, *Load Combinations and GTStrudl Model Load Development*, Rev. A, were not consistent with the requirements of SRD Safety Criterion 4.1-3 implementing codes and standards, e.g., ACI 318-99, *Building Code Requirements for Structural Concrete*; AISC M016-89, *Manual for Steel Construction – Allowable Stress Design*; and the 1997 Uniform Building Code (UBC). However, in response to Question AL-PSAR-018 concerning loads used in the laboratory calculations, the Contractor committed to correcting the load combinations and incorporating the revised loads into design calculations before the start of construction. During the review, these load combinations were subsequently corrected in Rev. B of calculation 24590-LAB-S0C-S15T-00006, *Structural Analysis Model (GTStrudl)*. Reviewers found this acceptable because the revised load combinations were consistent with the requirements of SRD Safety-Criterion 4.1-3.

(d) The reviewers found acceptable the definition of the specific loads encountered during normal plant construction, startup, operation, and shutdown, including dead loads, live loads, thermal loads, snow loads, ashfall loads, lateral earth pressures, and wind loads.

(e) Creep and shrinkage forces were discussed in PSAR Section 2.4.3.10, "Creep and Shrinkage Forces," and are excluded from detailed consideration in design.

Reviewers agreed that the facility is not of a size that would provide significant restraint to shrinkage and temperature changes.

4. The reviewers found acceptable the structural demands and strength capacities for each combination of factored loads for the analytical laboratory basemat, as provided in calculations 24590-LAB-DGC-S13T-00002, *Elevation +0 ft Basemat Concrete Reinforcement Design*, and 24590-LAB-DGC-S13T-00003, *C5 Cell Concrete Reinforcement Design.* These calculation reports provided the detailed design of rebar necessary to meet the code strength requirements of ACI 318-99. The reviewers assessed the calculations specifically for required strength for each load combination; use of strength reduction factors for each design strength for flexure, compression, shear, and tension; methods for determining controlling stress locations; minimum size and thickness requirements; rebar design and placement; rebar splice and embedment; and conservative factors to offset inaccuracies in computer model discretization and in the simplification of analysis approximations. The reviewers found the methods and calculations acceptable because they were consistent with DOE-STD-1020-94, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities,* and other applicable codes and because all the demand/capacity ratios presented were ≤1.0.

5. The reviewers found the design and analysis processes to be acceptable as noted in the following specific evaluations:

   (a) The reviewers found the description of the structural design software and applications to be acceptable as referenced in the PSAR Volume I, Section 2.4.8, "Computer Software."

   (b) The reviewers found the finite element model of the analytical laboratory to be acceptable. Calculation 24590-LAB-S0C-S15T-00006, Rev. A, was evaluated for the reasonableness of the assumptions and results from the design and analysis process and found to be acceptable.

   (c) The reviewers found the calculations 24590-LAB-DDC-S13T-00001, -00002, -00003, and -00005, *C5 Vessel Anchorage – Hot Cell Drain Collection, C2 Vessel Anchorage – Floor Drain Collection, C3 Vessel Anchorage – Lab Area Sink Drain Collection,* and *Hotcell Jib Crane Anchorage,* respectively, to be acceptable because the load, design/analysis methods, and capacities used were consistent with the applicable implementing codes and standards of SRD Safety Criterion 4.1-2.

   (d) The reviewers found the information on the seismic spectrum for design and analysis of the analytical laboratory structure and equipment acceptable because it was consistent with DOE-STD-1020-94 requirements. In response to Question AL-PSAR-016 concerning seismic design loads in the laboratory, the Contractor revised PSAR Section 2.4.5.3, "Seismic Analysis of Structures, Systems, and Components," to incorporate different "R-values" (R=7.5 for the steel superstructure and R=4.5 for the hotcell) to be consistent with the UBC implementing code and standard for Safety Criteria 4.1-2 and 4.1-3. The R-values were changed before the Contractor submitted the PSAR for final ORP review and approval. The Contractor also included appropriate factors in calculation 24590-LAB-S0C-S15T-00006, Rev. B, to account for the R-value changes.

(e) *The reviewers found acceptable the information on the structural design and analysis processes used for the analytical laboratory, including the processes for validating and verifying structural analysis codes. This information was acceptable because the design and analysis process conformed to the applicable SRD Safety Criterion 4.1-2 implementing codes and standards, including the requirements in DOE-STD-1020-94, AISC M016-89, ACI 318-99, and the UBC.

6. The Contractor's electrical design of the analytical laboratory had not been completed and therefore was not reviewed in detail. However, the reviewers found the general information on electrical systems and components, as described in PSAR Volume VI, Section 2.8, "Electrical," to be acceptable subject to the Contractor completing the actions described below. This information was acceptable because the facility electrical distribution system and equipment is neither safety class nor SS, which is consistent with the facility's hazard and accident analyses. The Contractor's DBE analyses do not take credit for electrical power for preventing or mitigating DBEs.

Information on the electrical power sources serving the facility was provided in PSAR Volume I, Section 2.8, and Volume V, Section 2,8, both entitled "Utility Distribution Systems," and previously reviewed and found to be acceptable. As described in PSAR Volume VI, Section 2.8, electrical loads in the facility are divided into two groups. Facility load groups are served by two independent feeders from the onsite 13.8-kV system, via two 13.8-kV/480-V transformers and associated load centers. The distribution system capacity and configuration allow the loads on both load centers to be served from either feeder if one transformer or feeder is out of service, using a normally open tie breaker and bus duct that connect the load centers.

Two non-safety class/SS battery-backed uninterruptible power supply (UPS) systems are provided for serving the integrated control network, stack discharge monitoring system, and selected analytical equipment. The design basis for cable raceways, lighting, cabling, grounding, lightning protection, and surge protection was consistent with the PSAR Volume I, which was previously reviewed and found to be acceptable.

In PSAR Table 3A-6, "Lab Additional Protection Class Structures/Systems/ Components," the Contractor had not identified that additional protection class (APC) components requiring electrical power to perform their APC safety function would require a power source also classified as APC. However, during a meeting with ORP on July 19, 2004, the Contractor committed to revising Table 3A-6 in the next PSAR update, to include APC classification for the electrical power distribution SSCs that serve the APC loads identified in the table. (See related Item 1, Section 3.3.2, and COA #1 in

Section 3.3.3 of this SER.) Because this revision would result in the APC classification of the electrical power distribution SSCs being consistent with the classification of the served APC loads that require power to perform their function, and because analytical laboratory PSAR Section 2.8, "Electrical," described a sufficiently reliable configuration for APC power, the reviewers found this acceptable subject to the Contractor revising Table 3A-6 in the next PSAR update.

7. The reviewers found the information on ventilation and air-cleaning systems for the analytical laboratory, as discussed in Section 2.6, "Confinement Systems," to be acceptable subject to the Contractor completing the actions described below. The reviewers found that the PSAR acceptably described the ventilation system and the approach to providing confinement barriers to protect the facility and co-located worker, the public, and the environment. The referenced codes and standards were found to be compatible and consistent with the implementing codes and standards of SRD Safety Criterion 4.2-1, the applicable design criterion.

   Three general confinement zones were described, referred to by classification zone designators C2, C3, and C5. Zone C2 areas were maintained uncontaminated but were adjacent to contaminated areas. Zone C3 included operating areas, which had low levels of contamination because of the work performed in them. Zone C5 included the hotcell and its ventilation system. The ventilation system includes the ductwork, filter trains, fans, stack, and controls that maintain the C5 confinement area at the lowest (most negative) pressure during normal operation as related to atmosphere and as compared with the other confinement areas of the facility. This information was found to be acceptable.

   The reviewers found the description of the passive confinement feature acceptable subject to the Contractor completing the actions described below. Reviewers questioned (Question AL-PSAR-003) the seat leakage criteria that would be imposed on the C3 decontamination glovebox isolation damper to ensure that the damper closes as part of the passive confinement design. In response, the Contractor stated that the C3 decontamination glovebox isolation damper C5V-YD-6229 would be purchased to bubble-tight leakage criteria and that it will fail closed on loss of differential pressure, power, or service air, thereby minimizing worker dose. (See related Item 5 in Section 3.3.2 of this SER.) The reviewers found this response to be acceptable. However, the Contractor did not specify periodic leak testing for this damper as part of the facility's TSRs. In response to question AL-PSAR-003, the Contractor committed to perform periodic leak testing of the damper to ensure bubble tight leakage characteristics consistent with DBE calculation input criteria. The reviewers found this to be acceptable subject to the Contractor incorporating this requirement in the next PSAR update.

   Reviewers questioned (Question AL-PSAR-005) the Contractor's definition of passive confinement as used for the analytical laboratory hotcell. In response, the Contractor defined the analytical laboratory passive confinement feature as containment of hazardous material achieved by the confinement structure, the C5 exhaust boundary, and the isolation dampers without forced air flow. Leakage from the passive confinement structure is unfiltered and accounted for in the DBE calculation. The term passive confinement, where used in the analytical laboratory PSAR or associated Standards Identification Process Database (SIPD), design basis calculations, or associated safety analyses, includes an active element, the C5V-YD-6229 damper, which must fail closed for the confinement boundary assumed in the safety analysis to be accurate. The single failure criterion for this active component was considered and rejected because of the high reliability of the damper. The damper is periodically tested to ensure operability, as discussed in Volume VI, Section 5.5.1, "LCO - C3 Decontamination Booth Isolation Damper and Interlock Operability." The reviewers found the revised passive confinement definition to be acceptable subject to the Contractor incorporating this definition in the next PSAR update.

In response to Question AL-PSAR-027 concerning the configuration and type of filters and functional requirement of the fire damper in the hotcell in-bleeds, the Contractor identified the filters located in the C2/C3 to C5 in-bleed ductwork as HEPA type. Additionally, the function of the fire damper located in the in-bleed ductwork was to protect the HEPA filter and did not have to be of a low seat leakage design. Operational verification testing will be performed on the fire dampers consistent with ASME AG-1 (UL 555S and NFPA 90A) requirements. This was acceptable to the reviewers given the function of the fire damper. Also, testing will be performed on the dampers to the implementing codes and standards of SRD Safety Criterion 4.4-3.

8. The reviewers found acceptable the information on how the effluent stack is represented because it was appropriately included in the analytical GTSTRUDL model used for designing the facility in calculation 24590-LAB-S0C-S15T-00006, Rev. B, which described the structural and seismic modeling of the analytical laboratory.

9. The reviewers evaluated the *Analytical Laboratory Hotcell Fire Hazard Analysis* (FHA) (24590-LAB-U1C-FPW-00001) and the fire DBE analysis (24590-LAB-Z0C-W14T-00006, *Design Basis Event: Fire in the Laboratory Facility*) for the scenario descriptions, assumed combustible loadings, potential for flashover, and fire effects on the hotcell structure and other facility SSCs. The hotcell FHA used hand calculations to show a peak heat release factor of 700 kW, which is significantly less than the 1542 kW calculated as necessary for flashover. The steel cell partitions (APC) were assumed to preclude the migration of fire between hotcells, so that the maximum fire consumed no more than the 30 lb of combustible material (polyethylene) located in hotcell No. 1, with a heat of combustion value of 46,500 kJ/kg.

   The fire DBE analysis analyzed a fire involving 32 lb of combustible material (polyethylene). The fire DBE concluded there would be no increase in cell pressure due to the analyzed fire and the HEPA filters would not fail due to temperature increase or plugging with fire effluent. The fire DBE credited the fire-resistive hotcell structure, with a calculated leak path factor of 0.50, with sufficient containment of radioactive material to reduce the unmitigated exposure to co-located workers from 50 rem to 8 rem. The analysis assumed the material was released through penetrations (e.g., seals) in the 30-inch thick hotcell walls. It also assumed all of the radiological material allowed in the

14 hotcells within the analytical laboratory was lumped in the mass of combustibles analyzed in hotcell No. 1. The steel cell partitions (APC) were credited with precluding the migration of fire between hotcells.

The analysis techniques used in both the hotcell FHA and the fire DBE analysis were reviewed and endorsed by an independent ORP contract fire protection technical reviewer.[10]

The reviewers questioned (Question AL-PSAR-019) the basis for the combustible loading used in the hotcell fire analysis, the reference to multiple scenarios, and the potential for flashover. The Contractor responded by clarifying that a single, consistent fire scenario is appropriate for the hotcell FHA and the fire DBE analysis and committed to revise the calculations using consistent input assumptions and fire scenarios. The revision will occur on a schedule mutually agreed to by the Contractor and ORP. In addition, the Contractor committed to itemize the combustibles, both fixed and transient, used in each hotcell analysis to confirm the assumed quantity of combustibles used in the analyses and agreed to show in the calculations the degree of conservatism by documenting the hypothetical combustible loading necessary to reach flashover conditions.

During meetings with the Contractor on July 21, 2004, regarding resolution of Question AL-PSAR-019, it was identified that the combustible load quantities analyzed in the fire DBE calculation and hotcell FHA may not be limiting. Quantities of combustible materials in the hotcells could be twice as high as was assumed in the analyses. Reviewers concluded that, given the margin to flashover conditions, on either a temperature or peak heat release basis (documented in the current hotcell fire analyses), the potential increase in combustible loads should not result in flashover conditions in the hotcells and would not result in a significant increase in the mitigated dose to the co-located worker due to cell pressurization during the fire event. As part of completion of the COAs listed below, this conclusion must be verified by the revised analyses (fire DBE and hotcell FHA) before the construction of analytical laboratory design features that could be impacted if flashover conditions are determined to exist.

As a COA, the Contractor will revise the fire DBE calculation (24590-LAB-Z0C-W14T-00006) and the hotcell FHA (24590-LAB-U1C-FPW-00001) to have consistent input (e.g., fire loading) assumptions and fire scenarios. Combustible load limits used in these calculations will be protected by operating limits defined in the WTP combustible control program and technical safety requirements (TSRs), as necessary. The amended calculations will (a) itemize and sum combustibles (fixed and transient) used in each hotcell analysis to confirm the assumptions used in the calculations and (b) show the degree of conservatism in the hotcell FHA analysis by calculating the hypothetical fire load necessary for flashover conditions.

[10] Letter from Schirmer Engineering Corporation to R. Griffith, ORP on SEC Project No. 1104060-000, dated July 12, 2004.

Process Description – The reviewers found the process description to be acceptable as described in Chapter 2 of the analytical laboratory PSAR. The evaluation of the information for each review criterion is summarized below:

1. The reviewers found the general description of the analytical laboratory process as found in Sections 2.5.1, "Basic Overview and Theory," 2.5.2.2, "Hotcell Processes," and Section 2.5.3.2, "Radiological Lab Processes," to be acceptable. The principal functions of the analytical laboratory are to support process control, waste form qualification testing, and receipt/analysis of samples. Figures 2A-6 through 2A-19 showed the major components and flow paths. The general description of both the hotcells and the radiochemistry labs and the processes that will be performed in these areas was acceptable. In addition, Table 3A-2 and Table 3A-3 provided a complete listing of the types and quantities of chemicals that will be used in the analytical laboratory and their hazardous characteristics. Table 3A-4 presented potential interaction of the laboratory reagents. Information on the laboratory chemicals was also presented in 24590-LAB-M0C-60-00005, *WTP Laboratory Chemical List*.

2. The reviewers found acceptable the general arrangement, function, and operation of major components for the process. Acceptable descriptions of the hotcell processes and the radiological laboratory processes were found in Sections 2.5.2.1, "General Hotcell Description," and 2.5.3.1, "General Radiological Laboratory Description," respectively. Figures 2A-1 through 2A-5 provided general arrangement drawings. The process equipment that will be used in the receipt and handling of samples, in the analyses to be run, and for disposal of wastes generated in the process were acceptably described in Sections 2.5.4, "Lab In-Cell Handling System," 2.5.5, "Radioactive Solid Waste Handling System," and 2.5.6, "Radioactive Liquid Waste Disposal System," respectively. The receipt and handling of samples and the generation and disposal of wastes present the most likely processes where process upsets could occur.

3. The reviewers found the description of process design in Sections 2.5.2.2, "Hotcell Processes," and 2.5.3.2, "Radiological Laboratory Processes," to be acceptable. In general, standard analytical laboratory processes (e.g., sample dissolution, solid/liquid separation, X-ray analysis, sample elemental analysis using mass spectrometry, radiation counting, particle size determination, and thermal gravimetric analysis) will be used in the hotcells or radiological laboratory to process the samples sent to the facility. Acceptable instrumentation and control systems were described for the radioactive liquid waste disposal system to prevent liquid overflows and worker exposures during operation. Acceptable control systems were also described for the various gas systems used in the analytical laboratory.

   The Contractor is also assessing use of laser ablation and other advanced analysis techniques for analyzing the samples. Laser ablation is still in the development stages and was not discussed in the PSAR. The impact on the analytical laboratory of using laser ablation or other more advanced analysis techniques will be addressed in future PSAR revisions.

4. The operating ranges and limits for process variables were not discussed in the PSAR. However, this was acceptable to the reviewers because standard analytical processes and instrumentation will be used to process the samples sent to the facility. The PSAR did discuss use of liquid level alarms at specified set points on the various liquid collection drain systems (e.g., the C2 floor drain collection system, the laboratory area sink drain collection vessel, and the hotcell drain collection vessel) to ensure that the collection vessels didn't overflow. However, the only SS instrumentation in the analytical laboratory is the flow instrumentation for the C3 decontamination booth damper, as discussed in PSAR Section 4.4.2.4.3, "Isolation Damper."

5. Process equipment layouts in the facility (in schematic drawings showing plan, elevation, and isometric views) were not provided in the PSAR. Figures 2A-2 through 2A-5 presented schematic drawings for the three building elevations but did not include process equipment layouts because the analytical laboratory equipment for both the hotcells and the radiological laboratory areas have not been assigned to individual cells and labs. Rather, analytical equipment was described in general terms only. This was acceptable to the reviewers. Actual process equipment layouts will be evaluated with the Final Safety Analysis Report (FSAR) when both hotcell equipment and radiological equipment layouts are finalized.

   Piping systems for the hotcell liquid waste handling systems were discussed in the facility description portion of the PSAR. The liquid waste handling vessels are located below grade in the C5 effluent vessel cell, the C3 effluent vessel cell, and the C2 fire water vault. The cells contain the collection vessel pumps and a sump area as part of a secondary containment system. The sump area is used to collect any vessel overflow or leakage. The pump is provided with a level sensor for leak detection. These systems were acceptable to the reviewers because none of these systems were ITS.

6. The reviewers found acceptable the discussion of the process design-related requirements, codes, and standards as found in Section 2.4.1, "Requirements, Codes, and Standards," as applied to both the civil/structural design and the SS laboratory facility SSCs. Analytical laboratory process-related SSCs identified as APC in Table 3A-6 included the automated sampling system, the hotcell drain collection vessel, and the radioactive liquid waste disposal pits and C5 tank cell. Appropriate implementing codes and standards will be applied to these systems. In addition, in response to Question AL-PSAR-036, the Contractor stated that the first confinement barrier against the hotcell fire is comprised of the containers storing the sample material in the hotcell. As such, these containers will be designated APC.

7. The processes that require instrumentation and controls in the laboratory are the liquid waste disposal system and the gas distribution systems. In Section 2.5.6, "Radioactive Liquid Waste Disposal System," instrumentation and controls required for monitoring the process and safely shutting down the process were acceptably described for the radioactive liquid waste disposal system to prevent liquid overflows and worker exposures during operation. Controls were also acceptably described for the gas systems used in the analytical laboratory in Sections 2.5.7, "Analytical Laboratory Breathing

Service Air," 2.5.8, "Analytical Laboratory Gas System," and 2.5.9, "Process Vacuum System." (Instrument and control for ventilation systems were discussed separately in PSAR Section 2.6, "Confinement Systems," as discussed in facility description Item 7 above.)

8. The process systems for waste management in the laboratory are the solid and liquid waste handling systems. The reviewers found the description of the facility design for reducing waste production and minimizing the mixing of radioactive and nonradioactive waste to be acceptable. Sections 2.5.5, "Radioactive Solid Waste Handling System (RWH)," and 2.5.6, "Radioactive Liquid Waste Disposal System," described the waste handling systems for the solid waste (both radioactive and hazardous) and the liquid waste generated during laboratory operations. Solid wastes, such as laboratory glassware, plastic bottles, failed equipment, HEPA filters, and prefilters, and debris such as personal protective equipment will be placed in 55-gal drums. The waste drums are transferred to the waste drum management areas where volume reduction is achieved as necessary using a standard industrial in-drum compactor fitted with HEPA prefilters that vent to the C3V system. Organic wastes will be sorted by compatibility and transferred to a special handling area in the laboratory for packaging. Liquid wastes will be collected from the radioactive labs, hotcells, and other laboratory areas in three distinct groups according to their potential contamination level (i.e., from areas controlled as C2, C3, or C5 ventilation areas). The radioactive liquid disposal systems collect, store, and transfer liquid effluents using self-priming horizontal centrifugal pumps located in the respective vessel cells. The liquid collection pits and sumps use alarms at specified liquid level set points to prevent overflow. Following collection, the liquid wastes will be sampled and pumped to the PT facility for further processing.

3.1.3 Conclusions

The reviewers concluded that the facility and process descriptions for the analytical laboratory PSAR were acceptable to support the hazard and accident analyses for the analytical laboratory facility subject to the Contractor completing the actions described below.

Conditions of Acceptance – BNI must complete the following by the date or milestone indicated:

1. Include the requirement to perform periodic leak testing on the C3 decontamination booth isolation damper C5V-YD-6229 to an acceptable leakage level and include the requirement as a TSR in the next PSAR update. (See Section 3.1.2, Item 7.)

2. Include the following definition of passive confinement in the next PSAR update: "The analytical laboratory passive confinement feature is defined as containment of hazardous material achieved by the confinement structure, the C5 exhaust boundary, and the isolation dampers without forced air flow. Leakage from the passive confinement structure is unfiltered and accounted for in the DBE calculation. The term passive confinement, where used in the analytical laboratory PSAR, or associated SIPD, design

basis calculations, or associated safety analyses, includes an active element, the C5V-YD-6229 damper, which must fail closed for the confinement boundary assumed in the safety analysis to be accurate. The single failure criterion for this active component was considered and rejected because of the high reliability of the damper. The damper is periodically tested to assure operability, as discussed in Section 5.5.1, "LCO - C3 Decontamination Booth Isolation Damper and Interlock Operability." (See Section 3.1.1, Item 7.)

3. Revise the fire DBE calculation (24590-LAB-Z0C-W14T-00006, *Design Basis Event: Fire in the Laboratory Facility*) and the *Analytical Laboratory Hotcell Fire Hazard Analysis* (24590-LAB-U1C-FPW-00001) to have consistent input (e.g., fire loading) assumptions and fire scenarios. Combustible load limits used in these calculations will be protected by operating limits defined in the WTP combustible control program and TSRs, as necessary. The amended calculations will (a) itemize and sum combustibles (fixed and transient) used in each hotcell analysis to confirm the assumptions used in the calculations and (b) show the degree of conservatism in the hotcell FHA analysis by calculating the hypothetical fire load necessary for flashover conditions. This will be done on a schedule mutually agreed to by the Contractor and ORP. (See Section 3.1.2, Item 9.)

3.2 Facility Hazard and Accident Analyses

The purpose of this review was to determine whether (1) the PSAR adequately described the hazard and accident analyses performed for the analytical laboratory, (2) the PFHA adequately described and analyzed the fire hazards associated with design and operation of the analytical laboratory and the fire protection measures in place to prevent or mitigate these hazards, and (3) the analyses complied with the requirements of the SRD and were consistent with the ISMP commitments. The review also was to determine whether the analyses demonstrated that the analytical laboratory design, construction, operation, maintenance, and deactivation could be performed in a manner that adequately protects the health and safety of the workers, the public, and the environment.

3.2.1 Requirements

According to the SRD, Appendix A, Section 4.0, "Hazard Evaluation," the submittal was to address the following nine elements of hazard and accident analyses: (1) identifying hazards, (2) identifying potential accident/event sequences, (3) estimating accident consequences, (4) estimating accident frequencies, (5) considering common-cause and common-mode failures, (6) defining DBEs, (7) defining the operating environment, (8) identifying potential control strategies, and (9) documenting the hazard evaluation. In addition, the identification of assumptions and analysis of uncertainty were to be evaluated. The descriptions were reviewed against criteria in RL/REG-99-05, Section 4.4, "Hazard Analysis Results."

For internal DBEs, the analytical laboratory evaluation should assess the identification and analysis of internal DBEs that can affect the design of laboratory ITS equipment and features and the overall facility.[11] For external DBEs, the evaluation should assess selection of the seismic and other external events for the analytical laboratory, including the seismic design criteria.[12] Facility preliminary seismic analyses should be evaluated to ensure that the preliminary analytical laboratory design would meet requirements for applicable loads when subjected to the design basis earthquake.

The chemical process safety of the design was also to be evaluated and was acceptable if it was adequate to identify the chemical hazards and integrate the chemical accident analyses into the overall preliminary safety analysis.[13] The PSAR was acceptable if the Contractor had implemented or committed to implement the 12 elements of a process safety management program as outlined in its SRD and ISMP;[14] if appropriate techniques, such as those described in the American Institute of Chemical Engineers' (AIChE's) *Guidelines for Hazard Evaluation Procedures*, *Second Edition with Work Examples*, were used for hazard evaluation and quantitative risk assessment; and if valid assumptions were used to assess the chemical process hazards.

For each fire area within the facility, the analytical laboratory PFHA (24590-LAB-RPT-ESH-02-001) is required to do the following according to SRD Safety Criterion 4.5-3:

- Properly account for all radioactive, hazardous, and combustible materials, including estimates of their heat content.
- Adequately describe the processes performed and their potential for fire or explosion.
- Properly account for the sources of heat and flame.
- List the fire detection and suppression equipment located in the fire area.
- Consider credible fire scenarios and evaluate the adequacy of the fire protection measures.
- Document the maximum possible fire loss.
- Consider other buildings or installations close to the analytical laboratory that contain flammable, combustible, or reactive liquid or gas storage.

The PFHA is also required to document the bases for concluding that the analytical laboratory can be placed in a safe state during and after all credible fire and explosion conditions.

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[11] RL/REG-99-05, Section 4.5, "Internal DBEs."
[12] RL/REG-99-05, Section 4.6, "External DBEs."
[13] RL/REG-99-05, Section 7.3, "Acceptance Criteria."
[14] RL/REG-99-05, Section 7.2, "Areas of Review."

3.2.2 Evaluation

The reviewers evaluated information provided in the analytical laboratory PSAR, Chapter 3, "Hazard and Accident Analysis," and Appendix A, "Analytical Laboratory Hazards Assessment Report; Standards Identification Process Database Output," against the applicable criteria defined in the SRD and RL/REG-99-05. Relevant references in the submittals were also reviewed to determine the implementation and documentation of the ISM process as it applied to the analytical laboratory hazards and accident analysis results. These references included calculations, studies, drawings, system notebooks, and additional detailed information from the SIPD, system description reports, and other relevant supporting documentation. All nine criteria were found to be acceptable subject to the Contractor completing the actions described below. The evaluation of the information for each review criterion is summarized below:

1. The reviewers found the identification of hazards to be acceptable, as described in the PSAR, Appendix A control strategy development (CSD) records, and in the hazard analysis results in 24590-LAB-RPT-ENS-04-001, *Analytical Laboratory Design Basis Event Selection Report*. PSAR Appendix A provided sufficiently complete lists of chemical and radiological hazards, potential consequences, possible causes, and estimated frequencies for the analytical laboratory. The reviewers concluded that the PSAR acceptably described the hazardous situations applicable to the operations and activities to be conducted in the analytical laboratory and provided the information necessary to conduct thorough and accurate accident analyses to define DBEs and hazard control strategies for the analytical laboratory. The information provided was consistent with the preliminary design of the facility and process.

   Because of the analytical laboratory's low radiological source term, the facility was preliminarily categorized as Hazard Category 3 using DOE-STD-1027-92, *Hazard Categorization, and Accident Analysis Techniques for Compliance with DOE Order 5480.23*, *Nuclear Safety Analysis Reports*. The reviewers evaluated the basis for this categorization (calculation 24590-LAB-U4C-60-00001, *Analytical Laboratory Hazard Categorization*) and found it to be acceptable.

2. The reviewers found the identification of potential accident/event sequences as described in PSAR Chapter 3, Appendix A CSD records, and in report 24590-LAB-RPT-ENS-04-001 to be acceptable subject to the Contractor completing the actions described below. PSAR Sections 3.3.1, 3.3.2, and 3.3.3[15] described the identification of internal and external events. The reviewers evaluated this information against acceptance criteria in RL/REG-99-05, Section 4.4.3.3, "Regulatory Acceptance Criteria," Item 2. The information satisfied the requirements in SRD Safety Criterion 3.2-1 and the SRD, Appendix A, Section 4.2, "Identification of Potential Accident/Event Sequences." The reviewers found that the PSAR (Chapter 3 and Appendix A) and the referenced calculations described (a) accident sequences that identified initiating events with their preventive and mitigative control strategies, (b) the rationale for sorting hazardous

[15] Section 3.3.1, "Hazard Identification," Section 3.3.2, "Hazard Identification Results," and Section 3.3.3, "Hazard Evaluation Results."

situations into accident groups or categories, and (c) the selection of comprehensive and credible accident sequences.

For internal events, the PSAR identified a fire in the hotcells as the only accident for which accident analysis was necessary. All other accident had consequences that were severity level (SL) SL-3 or lower for the public and co-located worker. For external events, a seismic event causing a fire in the hotcells was identified as the only accident for which accident analysis was necessary because a fire, regardless of cause, was the only hazardous event with SL-2 consequences to the co-located worker. No events were identified with SL-1 consequences to any receptor outside the facility.

Reviewers noted events involving interfacility transfer of samples via the pneumatic transfer system had not been addressed in the PSAR. In response to Question AL-PSAR-030 concerning pneumatic transfer of samples, the Contractor committed to include evaluation of interfacility sample transfer events in the next update of the PT facility-specific PSAR. This update will include transfers from all facilities using the appropriate facility-specific waste streams.

3. The reviewers found acceptable the estimate of accident consequences, as described in PSAR Chapter 3 and Appendix A CSD records; report 24590-LAB-RPT-ENS-04-001; and calculation 24590-LAB-Z0C-W14T-00003, *Severity Level Calculations for the Lab Facility*.

The reviewers found the PSAR estimates of unmitigated consequences for radiological and chemical hazardous situations in the analytical laboratory to be acceptable. The reviewers also found the mitigated consequences for the identified accident sequences and associated CSD records to be acceptable. The reviewers found these results satisfy the requirements of SRD Safety Criteria 3.1-1 and 3.2-1 and Appendix A, Section 4.3, "Estimation of Consequences."

PSAR Sections 3.3.3, "Hazard Evaluation Results," and 3.3.5, "Design Basis Event Selection," provided the results of the hazard analysis and DBE selection process used to determine the necessary unmitigated and mitigated consequence analysis for the potential accident/event sequences identified for the analytical laboratory. The reviewers evaluated this information against acceptance criteria in RL/REG-99-05, Section 4.4.3.3, "Regulatory Acceptance Criteria," Item 3. The results are discussed below:

(a) Unmitigated Consequences – For the analytical laboratory, the PSAR identified in the Appendix A CSD records the potential radiological and chemical hazard consequences for co-located workers and the public for radiological consequences above SL-4 and for chemical consequences above threshold. The reviewers found the PSAR estimates of accident consequences to be acceptable for hazard analysis.

For radiological consequences, the PSAR identified a hotcell fire as the only event with the potential for unmitigated consequences greater than SL-2 to the co-located worker (unmitigated consequences of 0.05 rem to the public; 50 rem to the co-located worker). No events were identified in the SIPD that resulted in above-threshold chemical consequences to the co-located worker or to public receptors. Accidents resulting in unmitigated radiological consequences equal to or lower than SL-3 or chemical consequences below threshold do not require mitigative or preventive controls to comply with SRD Safety Criteria 2.0-1 or 2.0-2. While controls in place for mitigating other hazards may be used to further reduce the risk of these lower risk events, they are not candidates for DBEs, which by definition, are used to derive bounding performance requirements for controls.

(b) Mitigated Accident Consequences – The PSAR contained a mitigated DBE evaluation of a fire in the hotcells. The reviewers also evaluated calculation 24590-LAB-Z0C-W14T-00006 and concluded that the appropriate methodology, data, and assumptions were used. The analysis results were acceptable and consisted of final control strategy selection, mitigated consequences with the credited mitigative and preventive controls (8 rem to the co-located worker; ≤0.05 rem to the public, not calculated), and compliance with SRD Appendix A criteria for meeting the radiation exposure standards of SRD Safety Criterion 2.0-1.

Reviewers questioned (Question AL-PSAR-034) the basis of the wind speed of 11.1 mph used in the hotcell fire DBE calculation. In response, the Contractor stated that a highest average wind speed of 11.1 mph was used in the DBE calculation based on meteorological data unique to Hanford. The fire in the laboratory hotcell DBE used a highest average wind speed of 11.1 mph for a release over eight hours. Using this wind speed is also consistent with the atmospheric dispersion coefficient used in the calculation. The reviewers found this to be acceptable because using the average wind speed over the eight-hour period accounts for variable wind speed, including wind gusts in calculating the total release and the total dose from the hotcell fire release consistent with information in Figure 1-6 of the PSAR Volume I. Additionally, inputs used in determining leak path factor were determined to be consistent with the methodology in DOE G 421.1-X, *Accident Analysis Guidebook for Interim Use and Comment*. Leakage area criteria used in the fire DBE calculation for hotcell windows, master slave manipulators, pipe and duct penetrations, and other potential leak paths were based on known standards and found to be acceptable and conservative.

4. The reviewers found the information on estimating accident frequencies to be acceptable. PSAR Appendix A CSD records contained acceptable estimates of the frequency of accident initiators. The estimation of accident frequencies relevant to the analytical laboratory was documented in PSAR Chapter 3, "Hazard and Accident Analysis," and Appendix A CSD records and in the hazard analysis in report 24590-LAB-RPT-ENS-04-001. These frequency determinations were based on methodology described in procedure 24590-WTP-GPP-SANA-002, *Hazard Analysis, Development of Hazard Control Strategies, and Identification of Standards*. The reviewers evaluated this information

against acceptance criteria in RL/REG-99-05, Section 4.4.3.3, "Regulatory Acceptance Criteria," Item 4.

The reviewers evaluated the CSD records for initiating event frequencies and assessed PSAR Section 3.3.3, "Hazard Evaluation Results," which indicated that radiological events were conservatively assigned an initiating event frequency that placed them in the unlikely event frequency bin unless the event initiator was an earthquake. The highest frequency of this unlikely event range, 0.01 events per year, was selected consistent with the highest failure rate for process vessels and piping recommended by procedure 24590-WTP-GPP-SANA-002. The reviewers found these values to be acceptable because they were consistent with data from other industrial sources, such as AIChE's *Guidelines for Process Equipment Reliability Data, with Data Tables*, and represented the mean value from these data sources.

5. The reviewers found acceptable the consideration of common-cause and common-mode failures as described in PSAR Section 3.3.4, "Common Mode and Common Cause Failures," and Appendix A CSD records, the hazard analysis in report 24590-LAB-RPT-ENS-04-001, and referenced DBE calculations. The reviewers evaluated the information against acceptance criteria in RL/REG-99-05, Section 4.4.3.3, "Regulatory Acceptance Criteria," Item 5. Credible common-cause events that could affect the analytical laboratory included natural phenomena events, external man-made events, loss of electrical power, fire, internal missiles, and internal flooding.

   PSAR Section 3.3.4 described three broad categories of dependencies used to classify and define the important common-cause failures. The PSAR addressed two of these, functional dependencies and spatial dependencies. Functional dependencies reflected the reliance of multiple systems, trains, or components on a single system, train, component, or process condition. Spatial dependencies determined the impact of failure of components as a result of their co-location in an area that experiences the effect of an event such as an explosion, flood, fire, seismic, or other natural forces and environmental stressors (e.g., extreme weather). Institutional dependencies come from activities within the plant which are conducted by maintenance workers, operators, designers, and equipment procurers that result in the near-simultaneous failure of otherwise independent components. Consideration of institutional dependencies was deferred until a later PSAR submittal when the plant maintenance, operations, and procurement activities become more developed. The reviewers agreed that deferring institutional dependencies was acceptable because, by their nature, they can be addressed in the programmatic development of the maintenance, operations, and procurement programs.

   PSAR Appendix A documented the results of hazard analysis, including potential common-mode and common-cause failures due to spatial and functional dependencies. This analysis included hazards associated with the potential for human error and external events that could initiate credible common-mode failures. The records also considered and identified credible common-mode failures of dependent subsystems (functional dependencies) and of SSCs whose functional capabilities the systems depend on (i.e., electrical power) through dependent failure modeling. The reviewers found the consideration of spatial and functional dependencies acceptable, recognizing that as the design evolves, different dependencies might be identified.

Spatial dependencies for the seismic DBE were acceptably considered by assuming that all SSCs will fail in a seismic event. The reviewers found this approach to be acceptable because it bounded common-cause failures from a seismic DBE and because the consequences of the DBE met the requirements of SRD Safety Criterion 2.0-1.

6. The reviewers evaluated both internal and external DBEs affecting the analytical laboratory and found them to be acceptable:

(a) Internal DBEs – The reviewers found the Contractor's selection of internal DBEs to be acceptable. The PSAR defined the bounding hazard control strategies for the analytical laboratory. Based on the DBE selection analysis in PSAR Sections 3.3 and 3.4 and Appendix A[16] and in report 24590-LAB-RPT-ENS-04-001, the Contractor concluded that only one internal DBE was relevant to the analytical laboratory: a fire in the hotcells. A fire in the hotcells was postulated as the result of various mechanisms, which include ignition of combustibles, short circuits, operating errors or other failures, and static electricity buildup. As documented in 24590-LAB-U1C-FPW-00001, the fire is nonmechanistically postulated to completely consume 30 lb of polyethylene equivalent, primarily sample containers and carriers. The fire, calculated to have a duration of 15.07 minutes, occurs in the same hotcell (HC 1 or HC 14) that is assumed to contain the total sample inventory in the analytical laboratory facility.

(b) External DBEs – The reviewers found the selection and analysis of external DBEs that affect the analytical laboratory (PSAR Section 3.4.2, "External Design Basis Events") to be acceptable according to the acceptance criteria in RL/REG-99-05, Section 4.6.3, "Acceptance Criteria." Based on the DBE selection analysis (report 24590-LAB-RPT-ENS-04-001), the Contractor concluded that only the seismic DBE that caused a fire could potentially affect the analytical laboratory. The seismic-induced fire was assumed to be identical to the fire described in Item (a) above, except that releases due to spills and drops caused by the seismic event increase the unmitigated consequences to the co-located worker to 55 rem. The mitigated consequences would not be significantly different from the 8 rem calculated for the internal fire DBE.

The reviewers found the information to be acceptable per the eight information criteria identified in RL/REG-99-05, Section 4.6.3.3.1, "Regulatory Acceptance Criteria for Seismic Events." Evaluation of the information for the seismic DBE for each of the eight information criteria is summarized below:

[16] Section 3.3, "Hazard Analysis," Section 3.4, "Accident Analysis," and Appendix A, "Analytical Laboratory Hazards Assessment Report; Standards Identification Process Database Output."

i. The reviewers found the identification of the analytical laboratory steel and concrete structures as SC-III to be acceptable because it was consistent with SRD Safety Criterion 4.1-3 requirements for SS SSCs.

ii. The reviewers found the selection and implementation of seismic design loads and criteria acceptable because they were consistent with the requirements of DOE-STD-1020-94 and SRD Safety Criterion 4.1-3 for SC-III SSCs that are SS. See Section 3.1.2 in this SER for additional discussion of specific NPH loads and design criteria.

iii. The reviewers found the seismic analysis methods, as previously described in PSAR Volume I, to be acceptable for the SC-III analytical laboratory. The reinforced concrete structures will be designed to ACI 318-99 and the steel structures to AISC M016-89.

While a complete review of the concrete structures and steel superstructure design could not be conducted because the Contractor's design had not been completed, the Contractor's design criteria were reviewed. The reviewers found acceptable the design codes and standards for the SC-III analytical laboratory building as presented in design criteria document 24590-WTP-DC-ST-01-001. These criteria, developed for WTP facilities, provided the minimum structural design criteria for buildings of each seismic category. The criteria ensure that building structures were designed to withstand the effects of natural phenomena events postulated to occur during the lifetime of the building. The criteria also described the natural phenomena event selected, the rationale for their selection, and the bases for the design and evaluation of ITS SSCs. Chapter 6 of document 24590-WTP-DC-ST-01-001 detailed the SC-III and SC-IV building requirements for reinforced concrete design, structural steel design, and masonry design. Load factors, load combinations, stability requirements, deflection, anchorage, and story drift requirements were established. The reviewers found document 24590-WTP-DC-ST-01-001 acceptable because it was consistent with the SRD Safety Criterion 4.1-3 and the implementing standard DOE-STD-1020-94.

iv. The reviewers evaluated seismic analysis calculation 24590-LAB-S0C-S15T-00006, Rev. B, including models and methods, and factored and combined total elements structural demands. The reviewers found the development and analysis of loading combinations, including seismic demands, to be acceptable because the methodology was consistent with the SRD Safety Criterion 4.1-3 requirements, including DOE-STD-1020-94.

v. The reviewers found acceptable the detailing requirements for anchoring the reinforcement bars in the reinforced concrete of the SC-III analytical laboratory. The detailing requirements were identified as ACI 318-99 and

DOE-STD-1020-94 as required by SRD Safety Criterion 4.1-3. Equipment anchorage requirements were taken from ACI 349-01, *Code Requirements for Nuclear Safety-Related Concrete Structures*, which was consistent with SRD Safety Criterion 4.1-3.

vi. DOE-STD-1020-94 does not require analysis of beyond-design-basis earthquake seismic events for PC-2 structures. (The analytical laboratory facility meets PC-2 structural requirements [SC-III]). However, beyond-design-basis seismic events were considered in evaluating the seismic probabilistic risk analysis that was performed for the analytical laboratory facility (see Section 4.3 of this SER).

vii. The reviewers found the methods for calculating the seismic loads to be acceptable because the methods were consistent with the requirements of DOE-STD-1020-94; ASCE 4-98, *Seismic Analysis of Safety-Related Nuclear Structures and Commentary*; and SRD Safety Criterion 4.1-3.

viii. The reviewers found the safety functions and the operability of each feature required for seismic safety of the analytical laboratory facility design to be acceptable. However, the reviewers questioned (Question AL-PSAR-035) whether structural cracks as a result of a fire DBE were considered. In response, the Contractor stated that the DBE fire calculation did not provide an additional allowance for leakage area from the hotcell due to structural cracks from the laboratory fire DBE. However, because the hotcell walls are about 3-feet thick, it was reasonable to assume any release or migration of material to the hotcell bay room would be through a more tortuous path than leakage around the penetrations that had been considered in the analysis. Based on the conservative nature of the leak paths already considered in the analysis and other conservative calculation inputs, the overall contribution of seismically induced cracks in the 3-foot-thick walls and the consequential release would be insignificant. The reviewers found this explanation acceptable.

For other external DBEs, the reviewers evaluated design information in the general and facility-specific sections and associated analyses. Reviewers considered snow, volcanic ash, wind, missiles dues to wind, and flooding events. The reviewers found the information provided for the six information areas identified in RL/REG-99-05, Section 4.6.3.3.2, "Regulatory Acceptance Criteria for Other External DBEs," to be acceptable. The evaluation of the information for each area is summarized below:

i. The reviewers found the wind loads quantified in calculation 24590-LAB-S0C-S15T-00002, *Wind Loads*, and calculation 24590-LAB-S0C-S15T-00006, Rev. B, to be acceptable. These analyses document that the facility's design correctly addresses SRD Table 4.1-2 requirements for wind loads.

ii. The reviewers found the statement in PSAR Section 2.4.3.6, "Wind Load, W," that indicated that missiles due to wind are not applicable to the analytical laboratory as a PC-2 structure per SRD Safety Criterion 4.1-3 to be acceptable because it was also consistent with SRD Table 4.1-2 and with the implementing DOE-STD-1020-94 requirements for PC-2 structures.

iii. No external flooding was considered for the analytical laboratory facility. The reviewers found this acceptable because, as stated in PSAR Volume I, Section 1.4.2.1, "Surface Water," the analytical laboratory facility is more than 150 feet above the maximum postulated flood level.

iv. The PSAR used design criteria for roof loads due to volcanic ashfall per SRD Safety Criterion 4.1-3 and therefore the criteria were acceptable. Ash loading was considered concurrent with roof live load as described and quantified in calculation 24590-LAB-S0C-S15T-00003, *Snow and Ash Loads*. This analysis showed that the facility met the applicable design requirements for withstanding loading due to volcanic ash.

v. The PSAR used roof snow loads, including snowdrift based on a ground snow load of 15 pounds per square foot (psf) according to PSAR Section 2.4.3.4, "Snow Load, S_N." The snow load was considered concurrent with roof live loading as described and quantified in calculation 24590-LAB-S0C-S15T-00003. This analysis showed that the facility's design included the applicable requirements of SRD Safety Criterion 4.1-3 for withstanding loading from snow. The reviewers found this analysis acceptable.

vi. The reviewers found that Volume I, Section 1.6.1, "Aircraft Activity," and calculation 24590-WTP-Z0C-50-00001, *Accident Analysis for Aircraft Crash into a RPP-WTP Facility*, included an acceptable evaluation of the impact of a plane crash and sufficient justification for not calculating the resulting exposures to the facility and co-located workers.

7. The reviewers found the definition of operating environments and performance requirements to be acceptable. According to requirements in SRD, Appendix A, Section 4.7, "Definition of Operating Environment," the PSAR identified a set of bounding operating conditions in which SSCs relied upon to control hazards must function. The bounding operating environmental requirements considered temperature, radiation levels, and chemical environmental requirements. The PSAR did not identify any special operating conditions for the analytical laboratory ITS SSCs related to pressure, humidity, and radiation levels (beyond design basis as a C5/R5 area) associated with the performance of its safety function. Conditions were described in Section 3.4.1.2,

"Laboratory Fire Analysis," for the hotcell fire DBE, which is the only DBE with SL-2 consequences to the co-located worker. Anticipated soot and radiological particulate loading on the exhaust HEPA filters were accounted for in the DBE calculation to conclude the filters will not be plugged by the DBE fire. The reviewers found the definition of operating environments and performance requirements for the analytical laboratory to be acceptable based on using bounding thermal conditions during normal and accident conditions. Tank overflow spill events are SL-3 to the co-located worker.

8. The reviewers found the identification of potential control strategies and documentation of required information for each ITS SSC to be acceptable. Information on potential control strategies was provided in PSAR Volume VI, Sections 3.3, 3.4, and 4.4,[17] and Appendix A CSD records, including control strategy elements (CSE) and safety case requirements (SCRs) identified in the CSD records. This information identified the potential control strategies associated with hazards, accident situations, and DBEs (e.g., seismic DBE). PSAR Chapter 4, "Important to Safety Structures, Systems, and Components," provided information for each ITS SSC according to RL/REG-99-05, Section 4.5.3.3.3, "Regulatory Acceptance Criteria." As discussed in this SER, Section 3.1.2, Item 7, the Contractor acceptably defined the concept of passive confinement and will add the definition in the next PSAR update (see Section 3.1.2, Item 7 in this SER.)

The passive confinement boundary, as defined above, comprises hotcell walls, C5 ductwork, exhaust HEPA filters and their housing, ember screens on the inlet and exhaust ducts for protecting HEPA filters, in-bleed HEPA filters and their housing, fire dampers on the inlet ducts, and the isolation damper on the C3 decontamination booth exhaust duct (and associated instrumentation and interlock). Other elements of the control strategy for the fire DBE are: hotcell partitions, a combustible loading program to limit combustibles to within calculation assumptions, and inventory control to limit the radiological material at risk to quantities assumed in the DBE calculation and hazard categorization. All the SSCs in the passive confinement boundary are SS because they are required to meet Safety Criterion 2.0-1; the hotcell partitions are classified APC. The combustible control program and inventory control are TSR administrative controls. The reviewers concluded that the selected CSEs are acceptable because the mitigated consequence of the fire DBE is within the SRD Safety Criterion 2.0-1.

The reviewers found the evaluation of facility worker impacts to be acceptable subject to the Contractor completing the action described below. Appendix A identified 16 accident events that had qualitatively determined "high" impacts to facility workers. SRD Appendix A, Section 4.3.1, "Accident Severity Level Identification," describes high impacts to facility workers as "Prompt worker fatality or serious injuries (e.g., immediately life threatening or permanently disabling) **or** significant radiological or chemical exposures [defined as] > 100 rem [or] ERPG-3." Fifteen of the 16 events had administrative controls as the primary SCR; the other event, misfeed of high activity waste from PT to the LAW building (CSD-UARL-N0008), had an SCR citing a safety design class requirement in the PT PSAR, Section 4.3.8, "Treated LAW Concentrate

[17] Section 3.3, "Hazard Analysis"; Section 3.4, "Accident Analysis"; and Section 4.4, "Safety Significant Systems, Structures, and Components."

Storage Vessel Gamma Monitor and Interlocks." All but 2 of the 15 events also included SS or APC SSCs as part of the control strategy at the analytical laboratory. The reviewers found these combinations of physical and administrative controls acceptable.

However, two other events identified only a single administrative control SCR for continuous radiation monitoring as the credited control strategy for protecting facility workers. Both of these events (CSD-UAHL/N0022 and CSD-UAHL/N0064) involve export of waste or samples from the hotcell. If such a transfer inadvertently involved high activity material, a high direct radiation exposure to workers could occur. Engineered controls were identified as Control Strategy Elements (CSE); however, none of these CSEs were credited as SCRs.

The basis for administrative controls as the principal or only hazard control strategy is provided in the SRD Appendix B, Table 1A under "Control Options for Implementation of Defense in Depth for Facility Worker." For high facility worker consequences: "At least one barrier shall be assigned to prevent or mitigate the impacts to the facility worker: If an administrative control barrier is selected, it must be developed into an SCR and TSR that capture the specific safety function related to the hazard."

Because these events only had significant consequences for the facility worker, the reviewers concluded the selected control strategy was acceptable.

Administrative controls for events with high facility worker consequences are identified in SCRs in Appendix A and TSRs are documented in PSAR Section 5.5.4, "Administrative Controls." All of the administrative controls are acceptable except for the fifth bullet in Section 5.5.4.3, "Administrative Controls - Radiation Protection," which states, "The program shall provide for continuous radiation monitoring at hotcell export points during sample export." This bullet must be broadened to include "radioactive material export" to ensure the specific safety functions relative to CSD-UAHL/N0022 and CSD-UAHL/N0064 and the associated SCR-UADM/N0009 are developed into a TSR, as required. This condition of approval must be accomplished in the next PSAR update.

9. The reviewers found the documentation of the hazards evaluation and accident analysis, as presented in PSAR Chapter 3, "Hazard and Accident Analysis," Appendix A CSD records, and in report 24590-LAB-RPT-ENS-04-001, to be acceptable subject to the Contractor completing the actions described below. Uncertainties in models (e.g., input assumptions, boundary conditions, and modeling techniques), data, and phenomenology used in estimating accident consequences and frequencies were described in the calculations for DBEs. In the DBE analysis, these calculations also identified other uncertainties and assumptions important to the calculation results. The reviewers evaluated these descriptions in the DBE calculations and found them to be acceptable, given the preliminary status of design and associated flowsheets. In the analysis of the only identified DBE, an internally generated or seismic-induced fire, both the total transient combustibles allowed by administrative control and the maximum radiological inventory were assumed to be in the same single hotcell. The combustible, bottle

material polyethylene, as well as the radiological samples, are in 20 mL containers when they are received in the hotcell; the assumption is made that both the combustible and the sample material are lumped masses to maximize both the fire magnitude and the release of the material. Other conservative assumptions to address uncertainty are, the inclusion in the material at risk of 5 L of sample material for troubleshooting analyses simultaneously with 5 L of sample material for optimization studies; that all the liquid samples are tank farm waste, which has the highest unit liter dose of all waste anywhere in the WTP facilities; and that the glass samples are loose powder.

Reviewers questioned (Question AL-PSAR-006) using 24590-WTP-RPP-ESH-001, *Radiation Protection Program for Design and Construction (RPP)*, in Chapter 3 and Appendix A of the analytical laboratory PSAR as the basis for operational administrative radiological controls to limit worker exposures. In response, the Contractor committed to do the following by the date or milestone indicated:

(a) For the general information PSAR, revise Chapter 7, "Radiation Protection," to provide sufficient detail on administrative radiological controls to clearly demonstrate that the controls are adequate to limit potential worker exposure as credited. This will be done with the FSAR, consistent with completion of the seven existing radiation protection COAs from the Volume I PSAR review (ORP/OSR-2002-18).

(b) For the analytical laboratory PSAR, remove references to the Radiation Protection Program as the basis for administrative radiological controls and describe the specific administrative controls required. This will be done in the next PSAR update.

(c) For the HLW, LAW, and PT PSARs, remove references to the Radiation Protection Program as the basis for operational administrative radiological controls that do not explicitly appear in the Radiation Protection Program; this will be done in the next PSAR update. Also, in the FSAR remove all other Radiation Protection Program references that do not reference a specific control.

These commitments were acceptable to the reviewers because the changes will provide a detailed description of applicable administrative radiation protection controls in the PSARs.

The reviewers evaluated information provided for each fire area within the analytical laboratory PFHA against SRD Safety Criterion 4.5-3. The reviewers determined that the analytical laboratory PFHA acceptably documented and analyzed the elements of fire hazards analysis. Specifically, the reviewers determined that PFHA Section 1, "Introduction," acceptably provided a project overview; described the objectives, scope, and limitations of the fire hazards analysis; and provided the bases for the quantification of combustible materials, radiation levels, and contamination levels in the facility. Further, the reviewers found that PFHA Section 2, "Hanford Tank Waste Treatment and Immobilization Plant: Site Overview," acceptably described the WTP site, site fire protection features and systems, WTP fire detection and alarm systems, emergency planning and fire department response times and capabilities, and security and safeguards considerations related to fire protection. Finally, the reviewers determined that, with one exception (discussed below), PFHA Section 3, "Analytical Laboratory," acceptably described the function and arrangement of analytical laboratory building areas, the construction of the analytical laboratory facility, the life safety features incorporated into the analytical laboratory design, and facility fire protection features.

The analytical laboratory was classified as a Type II-B (noncombustible) structure per the requirements of the *International Building Code* (2000). The reviewers evaluated the basis for this classification and found it acceptable. Occupancy classifications per the *International Building Code* 2000 were identified as either Group B or Group F-2. The reviewers evaluated the bases for these classifications and found them acceptable. The reviewers concluded that life safety features incorporated into the design of the analytical laboratory were adequate for the safe egress of facility personnel during emergency situations. The reviewers determined that PFHA Section 3.4.3, "Exposure Fire Protection," acceptably described the exposure fire hazard to the analytical laboratory from adjacent WTP structures and installations and from transient vehicle fires. The reviewers determined that the fire water drainage and collection systems were adequate to control and contain potentially contaminated fire water. Ventilation systems were found to provide adequate smoke control for postulated fires throughout the analytical laboratory. Finally, the reviewers determined that PFHA Section 3.8, "Fire Hazards Analysis," provided an acceptable fire hazards analysis for each of the seven fire areas within the analytical laboratory.

The reviewers found acceptable the description of the following: fire area fire protection features, fire hazards, life safety considerations, protection of ITS and safe state systems, exposure fire potential and the potential for the spread of fire beyond the fire area boundary, design basis fire scenario selection and analysis, consequences of automatic fire suppression system failure, potential for a toxic or radiation incident due to a fire, and recovery potential. The reviewers determined that PHFA Appendix A, "Systems Required to Achieve and Maintain Safe State," acceptably described systems required to achieve and maintain safe state consistent with the preliminary design of the analytical laboratory.

Although the description of the analytical laboratory construction was generally determined to be acceptable by the reviewers, they questioned (Question PFHA-AL-001) the fire-resistive characteristics of the hotcell enclosure (Fire Area LB101) in terms of rated fire construction to provide containment of the design basis hotcell fire event. The Contractor responded that a fire integrity evaluation of the analytical laboratory hotcell determined the fire-resistive characteristics of the hotcell enclosure at least equivalent to a 4-hour fire rating. Further, the Contractor committed to incorporate the results of the hotcell fire duration calculation 24590-LAB-U1C-FPW-00001 and the hotcell construction description contained in the fire integrity evaluation[18] into the next update of

[18] CCN: 076664, BNI Internal Memo to Files from C. W. McKnight, "Lab Hotcell Fire Integrity Evaluation," dated March 16, 2004.

the analytical laboratory PFHA. This is acceptable to the reviewers because the 4-hour equivalency fire rating of the hotcell enclosure is considered to be significantly more robust than is required for the worst-case fire event postulated for the hotcell (≤1 hour in duration).

3.2.3 Conclusions

The reviewers concluded that the PSAR hazard and accident analyses for the analytical laboratory was acceptable subject to the Contractor completing the actions described below. The hazards information, as supplemented by information in responses to reviewer questions and Contractor calculations, was consistent with the current status of the facility and process design described and analyzed, and the control strategies were adequate for the hazards. With the exceptions identified below, the radiological, nuclear, and process hazards associated with facility operation, including those from postulated accidents, were acceptably assessed and sufficient preventive or mitigative features were identified.

Conditions of Acceptance – BNI must complete the following by the date or milestone indicated:

1. Include evaluation of interfacility sample transfer events, including transfers from all facilities using the appropriate facility-specific waste streams, with the next update of the PT facility-specific PSAR. (See Section 3.2.2, Item 2.)

2. Revise bullet 5 in PSAR Section 5.5.4.3, "Administrative Controls - Radiation Protection," to include "radioactive material export" to ensure the specific safety functions relative to CSD-UAHL/N0022 and CSD-UAHL/N0064, and the associated SCR-UADM/N0009 are developed into a TSR. This must be accomplished in the next PSAR update. (See Section 3.2.2, Item 8.)

3. Revise the PSARs as follows (see Section 3.2.2, Item 9.):

   (a) For the general information PSAR, revise Chapter 7, "Radiation Protection," to provide sufficient detail on administrative radiological controls to clearly demonstrate that the controls are adequate to limit potential worker exposure as credited. This will be done with the FSAR, consistent with completion of the seven existing radiation protection COAs from the Volume I PSAR review (ORP/OSR-2002-18).

   (b) For the analytical laboratory PSAR, remove references to the Radiation Protection Program as the basis for administrative radiological controls and describe the specific administrative controls required. This will be done in the next PSAR update.

   (c) For the HLW, LAW, and PT PSARs, remove references to the Radiation Protection Program as the basis for operational administrative radiological controls that do not explicitly appear in the Radiation Protection Program; this will be done in the next PSAR update. Also, in the FSAR remove all other Radiation Protection Program references that do not reference a specific control.

4. Incorporate the results of the hotcell fire duration calculation 24590-LAB-U1C-FPW-00001, *Analytical Laboratory Hotcell Fire Hazard Analysis*, and the hotcell construction description contained in the fire integrity evaluation into the next update of the analytical laboratory PFHA. (See Section 3.2.2, Item 9.)

3.3 Facility ITS SSCs

The purpose of this review was to determine whether the PSAR adequately identified the analytical laboratory ITS SSCs, including their classification as safety class, SS, or APC, and the most severe anticipated conditions under which they must function. Safety class and SS SSCs are required to provide the necessary preventive or mitigative functions credited in the accident analysis to protect the co-located worker and the public. The APC subclassification replaced the risk reduction class (RRC) classification and is defined as all ITS SSCs under the new classification scheme that are neither safety class nor SS. The analytical laboratory PSAR included only two designations for ITS SSCs: SS and APC because no hazards were identified that warranted safety class designation using the SRD, Appendix A, Section 6.0, "Classification of Structures, Systems, and Components."

The Contractor requested the use of the safety class, SS, and APC classifications in July 2003.[19] ORP subsequently approved the Authorization Basis Amendment Request (ABAR) in September 2003.

In April 2004, the Contractor submitted an ABAR[20] to modify SRD Safety Criteria 4.4-3 and 4.4-5 and tailor Appendix C, Sections C.17, C.19, and C.21, to allow the use of SS in lieu of safety design significant for the analytical laboratory facility. This was done to align the SRD with the functional classifications scheme used for the laboratory PSAR based on the requirements of DOE-STD-3009-94, *Preparation Guide for the U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports.* ORP subsequently approved the ABAR subject to the condition that SRD Safety Criterion 4.3-2 was also revised to add ANSI/ANS 58.9-1981, *Single Failure Criteria for Light Water Reactor Safety-Related Fluid Systems,* as an implementing code and standard.[21]

[19] CCN: 057321, BNI letter from J. P. Henschel to R. J. Schepens, ORP, "Transmittal for Approval: Authorization Basis Amendment Request 24590-WTP-ABAR-ENS-03-032, Revision 0, Redefinition of ITS SSC Subclassifications and Defense in Depth Determination," dated July 2, 2003.
[20] CCN: 085305, BNI letter from J. P. Henschel to R. J. Schepens, ORP, "Transmittal for Approval: Authorization Basis Amendment Request 24590-WTP-SE-ENS-04-032, Revision 0, Revisions to the SRD for Safety Significant SSCs," dated April 15, 2004.
[21] 04-WTP-088, ORP letter from R. J. Schepens to J. P. Henschel, BNI, "Approval of Authorization Basis Amendment Request (ABAR) 24590-WTP-SE-ENS-04-032, Revision 0, 'Revisions to the Safety Requirements Document (SRD) for Safety Significant Structures, Systems, and Components (SSCs),'" dated May 5, 2004.

3.3.1 Requirements

The PSAR submittal was to identify analytical laboratory ITS SSCs and address the following six elements, which are repeated for each ITS SSC: (1) SSC identification, (2) safety function, (3) system description, (4) functional requirements, (5) system evaluation, and (6) TSRs. This section addresses the first five elements. Information on the review of the TSRs is contained in Section 3.4 of this SER.

The PSAR must also identify the most severe environmental conditions under which ITS SSCs in the analytical laboratory must function, including temperature, pressure, humidity, radiation level, and chemical environment.[22] The hazard control strategies selected must be shown to be consistent with the most severe environmental conditions identified. The operating environment during normal operations and under off-normal and accident conditions, as it affects the analytical laboratory ITS SSCs, must be considered.

3.3.2 Evaluation

Reviewers found the identification of ITS SSCs and associated safety functions, system descriptions, functional requirements, and systems evaluations, as found in PSAR Volume VI, Chapter 4, "Important to Safety Structures, Systems, and Components," to be acceptable subject to the Contractor completing the actions described below. The reviewers found that the analytical laboratory facility's ITS SSCs would acceptably perform their safety functions under all normal, off-normal, and accident environmental conditions.

This review included evaluation of all ITS SSCs. No safety class SSCs were identified in Chapter 3, "Hazard and Accident Analysis," to prevent or mitigate DBEs, only SS and APC SSCs. Evaluation of the information on ITS SSCs for each element is summarized below. The evaluation of information related to TSRs is summarized in Section 3.4 in this SER.

1. The reviewers found the identification of SS SSCs acceptable, as described in Chapter 4. Three SS SSCs were identified: (1) laboratory structure, (2) passive confinement, including an active (fail closed) ventilation damper, and (3) PT transfer pipes.

   The reviewers found the identification of APC SSCs to be acceptable subject to the Contractor completing the actions described below. The Contractor identified the following 12 APC SSCs in PSAR Volume VI, Table 3A-6: (1) automatic sampling system, (2) hotcell structure, (3) laboratory structure (for protection against NPH events other than seismic), (4) partition walls in hotcells, (5) C5 ventilation fans, (6) C5 ventilation ducting downstream of the secondary C5 HEPA filters (including the stack), (7) backflow preventer in the demineralized water supply piping, (8) demineralized water supply piping from the backflow preventer to the C5 pits, (9) vent connections from the pump pits [2] and valve pit to the C5 vessel cell, (10) hotcell drain collection vessel, (11)

[22] SRD, Appendix A, Section 4.7, "Definition of Operating Environment."

radioactive liquid waste disposal system pits and C5 tank cell, and (12) C5 ventilation controls.

Reviewers questioned (Question AL-PSAR-036) the designation of an administrative control, radioactive material inventory control, as one of two independent physical barriers to provide defense in depth for co-located workers from a SL-2 hazard, the other barrier being the passive confinement boundary. In response, the Contractor proposed the sample containers as the first physical barrier and committed to classify the bottles in which samples are stored in the hotcells as APC. The reviewers found this approach acceptable because it complied with the defense in depth requirements.

Reviewers also questioned the completeness of the APC SSCs listed in Table 3A-6. Based on discussions with the Contractor, the Contractor committed to add the following APC items to Table 3A-6 in the next PSAR update: (1) accident monitoring instrumentation; (2) electrical power distribution SSCs, including UPS supply, that serve APC loads [C5 ventilation fans, Area Radiation Monitors (ARMs), Continuous Air Monitors (CAMs), and accident monitoring instrumentation]; (3) automatic fire suppression system, including fire water system and controls for monitoring and supplying water to the sprinklers; (4) C5 exhaust duct between decon hotcell and C5V-YD-6229 damper; (5) piping to hotcell drain collection vessel (RLD-VSL-00165); (6) automatic transfer system instrumentation to detect sample holdup in ASX, (7) permanent CAMs, (8) permanent ARMs, (9) gamma monitor inside hotcell transfer port, (10) gamma monitor in hotcell transfer drawer, and (11) leak detection equipment in C5 tank cell sump.

2. The reviewers found the safety function descriptions of SS SSCs to be acceptable, as described in Chapter 4. For each SS SSC identified, the PSAR included a section that described the credited safety function. The reviewers found the safety function descriptions to be acceptable because they were consistent with the hazard control requirements identified in the SIPD, as related to the DBE, and were consistent with the requirements of the SRD. As discussed in SER Section 3.1.2, Item 7, the Contractor acceptably defined the concept of passive confinement and will add the definition in the next PSAR update.

   The reviewers found that the safety functions of the APC SSCs were acceptably described for the twelve APC SSCs described in PSAR Volume VI, Table 3A-6. However, additional safety functions are required for the new APC SSCs to be added to Table 3A-6 (see Item 1 above).

3. The reviewers found the system descriptions of SS SSCs to be acceptable, as described in Chapter 4. For each SS SSC identified, the PSAR included a section that described the SSC. The reviewers found the descriptions to be acceptable because they were consistent with the hazard controls determined through the ISM process and documented in the SIPD and with the applicable requirements of the SRD, specifically Safety Criteria 2.0-1, 2.0-2, 4.2-2, and 4.3-4.

APC SSCs are similar to RRC SSCs in that their safety functions are not credited for meeting the radiological exposure standards for the public or co-located workers. The primary function of APC SSCs is to provide defense in depth and protection for facility workers; therefore, there is no requirement to include system descriptions, functional requirements, or system evaluations for APC SSCs in PSAR Chapter 4. Table 3A-6 in PSAR Volume VI, Chapter 3, "Hazard and Accident Analyses," listed the safety functions of APC SSCs; system descriptions in PSAR Volume VI, Chapter 2, "Facility Description," covered APC SSCs in acceptable detail.

4. The reviewers found the functional requirements of SS SSCs, as described in Chapter 4, to be acceptable subject to the Contractor completing the actions described below. For each SS SSC identified, the PSAR included a section that described the functional requirements of the SSC.

   During the review of the functional requirements for the analytical laboratory's "passive confinement" system, the reviewers questioned (Question AL-PSAR-020) the procedures and methods for ensuring that the fire resistance of the passive confinement boundary is maintained during the time the various openings in the boundary (e.g., shield windows, service embeds, glove boxes, hotcell monorail airlocks, trolley containment troughs, and master/slave manipulators) are removed for maintenance, repair, etc. The Contractor responded that their Fire Safety group (E&NS) has drafted a fire protection system impairment procedure and committed to implement the procedure prior to commissioning of the analytical laboratory. The reviewers determined this response was acceptable subject to the condition that the fire protection system impairment procedure be implemented prior to commissioning the analytical laboratory.

   The reviewers concluded that the functional requirements provided were commensurate with the level of detail at the preliminary design stage and were consistent with credited safety functions in the hazard analysis.

5. The reviewers found the system evaluations of SS SSCs, as described in Chapter 4, to be acceptable subject to the Contractor completing the actions described below. For each SS SSC identified, the PSAR included a section that evaluated the SSCs' functional requirements versus the proposed design information. The reviewers found the system evaluations to be acceptable because they acceptably discussed system performance as it related to safety functions credited in hazard analysis.

   The reviewers determined that the Contractor had not identified the types of variables and instruments used to satisfy SRD Safety Criterion 4.3-4 and its tailored implementing standard IEEE 497-2002, *IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations*. However, in response to Question AL-PSAR-013 concerning the basis for post-accident monitoring for the analytical laboratory facility, the Contractor committed to describe the accident monitoring instrumentation, its safety classification, and associated variable types, pursuant to the tailored version of IEEE 497-2002 and governed by the ISM process, in the next PSAR update. Because the design had not yet evolved to this level of detail, the reviewers found this response acceptable, pending submittal of this information in the next PSAR update.

The reviewers determined that the Contractor had not provided a basis for how the isolation damper, which closes on low flow in the C5V exhaust duct from the C3 decontamination booth, would not be adversely affected by the DBE fire in the hotcell. (See related Item 7 in Section 3.1.2 of this SER) In response to Question AL-PSAR-014 concerning the basis for implementing standards and consequences of a fire defeating the low flow interlock, the Contractor stated that the interlock and the damper are external to the hotcell and that calculation 24590-LAB-Z0C-W14T-00006 determined that the maximum temperature in the C5 exhaust ducting during the hotcell fire would be <150ºC, which would also be the maximum temperature that could occur at the C3 decontamination booth damper. To ensure that the damper would perform its isolation function for the design basis fire, the Contractor committed to either (1) specify and procure the damper to remain functional at the elevated temperature or (2) evaluate the maximum temperature at the damper location and protect the damper against the elevated temperature in the next PSAR update. Because the design had not yet evolved to this level of detail, the reviewers found either approach acceptable for ensuring the damper would perform its isolation function for the DBE fire.

3.3.3 Conclusions

The reviewers concluded that PSAR Volume VI, Chapter 4, was acceptable for identifying ITS SSCs to implement the hazard control strategies for the analytical laboratory, subject to the Contractor completing the actions described below.

Conditions of Acceptance – BNI must complete the following by the date or milestone indicated:

1. Classify the bottles in which samples are stored in the hotcells as APC. (See Section 3.3.2, Item 1.)

2. Add the following APC items to Table 3A-6 in the next PSAR update: (1) accident monitoring instrumentation; (2) electrical power distribution SSCs, including UPS, that serve APC loads [C5 ventilation fans, Area Radiation Monitors (ARMs), Continuous Air Monitors (CAMs), and accident monitoring instrumentation]; (3) automatic fire suppression system, including fire water system and controls for monitoring and supplying water to the sprinklers; (4) C5 exhaust duct between decon hotcell and C5V-YD-6229 damper; (5) piping to hotcell drain collection vessel (RLD-VSL-00165); (6) automatic transfer system instrumentation to detect sample holdup in ASX; (7) permanent CAMs; (8) permanent ARMs; (9) gamma monitor inside hotcell transfer port; (10) gamma monitor in hotcell transfer drawer; and (11) leak detection equipment in C5 tank cell sump. (See Section 3.3.2, Item 1.)

3. Implement the fire protection system impairment procedure prior to commissioning of the analytical laboratory. (See Section 3.3.2, Item 4.)

4. Describe the accident monitoring instrumentation, its safety classification, and associated variable types, pursuant to the tailored version of IEEE 497-2002, *IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations*, and governed by the ISM process. (See Section 3.3.2, Item 5.)

5. Either specify and procure the C3 decontamination booth isolation damper C5V-YD-6229 to remain functional at the elevated temperature (150^{o}C) or evaluate the maximum temperature at the damper location and protect the damper against the elevated temperature. (See Section 3.3.2, Item 5.)

3.4 Facility TSRs

The purpose of this review was to determine whether the analytical laboratory submittal adequately described appropriate draft TSRs for the hazard control provisions and strategies for the analytical laboratory according to the applicable Contract requirements. The review was also to determine whether the submittal adequately provided the basis for developing the TSRs to ensure that the analytical laboratory will operate within the analyzed safety basis.

3.4.1 Requirements

Table S7-1 of the BNI Contract[23] specifies that draft TSRs will be submitted with the CAR, and the SRD defined the required content of the TSRs. SRD Safety Criterion 9.2-1 stated that TSRs shall be prepared and submitted for approval and the facility shall be operated according to the approved TSRs. SRD Safety Criterion 9.2-3 states that TSRs shall consist of the following: (1) safety limits, (2) operating limits, (3) limiting control settings, (4) limiting conditions of operation, (5) surveillance requirements, (6) administrative controls, (7) use of application provisions, (8) design features, and (9) bases appendix (bases for the TSRs and the facility's design features). Finally, SRD Safety Criterion 9.2-4 stated that TSRs shall be kept current at all times so they reflect the facility as it exists and as it is analyzed in the safety analysis report.

3.4.2 Evaluation

The analytical laboratory PSAR included draft TSRs that provided information commensurate with the current preliminary stage of facility design. These draft TSRs included limiting conditions of operation, associated surveillance requirements (mostly to be determined), administrative controls, bases (also mostly to be determined), and design features. No safety limits were identified. The review of the draft TSRs was limited to consistency checks (1) for assurance that safety functions derived in PSAR Section 3.4.1, "Internal Design Basis Events,"

[23] Contract DE-AC27-01RV14136 between DOE/ORP and BNI, as amended.

were carried forward to form the basis for the derivation of TSRs in PSAR Chapter 5.0 and (2) between the TSR derivation in PSAR Chapter 5.0, "Technical Safety Requirements," and the draft TSRs. The reviewers noted that limiting conditions of operations and surveillance requirements were identified to protect the active safety functions of SS SSCs; design features were identified to protect passive safety functions by maintaining the configurations assumed in the hazard and accident analyses; and administrative controls were defined to describe safety management programs. The reviewers found the draft TSRs acceptable. Detailed review leading to approval of TSRs will be performed with the review of the FSAR before facility operation is authorized.

3.4.3 Conclusions

The reviewers concluded that the draft TSRs provided with the analytical laboratory PSAR were commensurate with the preliminary design and were acceptable for authorization for full analytical laboratory construction.

4.0 EVALUATION – SRD AND ISMP COMPLIANCE AND OPEN ITEMS REVIEW

In addition to submittal of the analytical laboratory PSAR for construction authorization, the Contractor was required to submit additional documentation demonstrating that it was ready for construction.[24] This section discusses the evaluation of the additional documentation, open items from the Initial Safety Analysis Report (ISAR) review and Topical Meetings items, and conformance with facility risk goals.

4.1 SRD and ISMP Acceptability and Compliance

The purpose of this review was to determine whether the Contractor was compliant with the SRD and ISMP. The reviewers determined compliance by integrating the results of the PSAR review with the results of ORP assessments of the Contractor as they relate to SRD and ISMP activities.

4.1.1 Requirements

DOE/RL-96-0003, Section 3.3.3, "Authorization for Construction," Items 1 through 3, contain the requirements for reviewing the Contractor's compliance to the SRD and ISMP and state that construction authorization will be issued by the ORP Manager based on the determination that (1) "the Contractor's important-to-safety activities are being conducted according to its approved ISMP, (2) the proposed changes to the SRD and ISMP are acceptable, and (3) the Contractor's design complies with the design-related part of the updated SRD."

[24] DOE/RL-96-0003, Section 4.3, "Authorization for Construction."

RL/REG-99-05, Section H, "SRD and ISMP Acceptability and Compliance," interprets this contractual requirement by stating that compliance to the SRD and ISMP was acceptable if the following criteria were met:

1. The Contractor provided an assessment of compliance to the SRD and ISMP (as required by DOE/RL-96-0003, Section 4.3.2).

2. The safety-related activities will be conducted according to the approved ISMP.

3. The design complied with the design-related portions of the SRD.

4. The proposed changes to the SRD and ISMP were acceptable.

5. The SRD complied with the requirements of the SRD, Appendix A, Section 11.0, "Maintenance of the SRD," and the SRD, Appendix I, Section 3.3, "Changes to the Authorization Basis."

6. Revisions to the SRD complied with the SRD, Appendix A, "Implementing Standard for Safety Standards and Requirements Identification."

7. The Contractor adequately followed the procedure described in the SRD, Appendix A, Section 11.0, "Maintenance of the SRD," for independent review and assessment of SRD changes.

4.1.2 Evaluation

The reviewers evaluated SRD and ISMP acceptability and compliance by integrating the results of all Partial Construction Authorization Request (PCAR) and PSAR reviews with the results of ORP assessments of the Contractor as they related to the PSAR activities. The evaluation of the information for each criterion is summarized below:

1. The reviewers found the Contractor's assessment of compliance with the SRD and ISMP to be acceptable. The Contractor stated[25] that its compliance to the SRD and ISMP remained the same for the analytical laboratory PSAR as had been stated earlier in its submittal of the PCAR for the WTP.[26] The SRD and ISMP contain radiological, nuclear and process regulatory commitments that, if applicable, must be implemented to perform project construction activities. The Contractor used the following approach:

[25] CCN: 090795, BNI letter from J. P. Henschel to R. J. Schepens, ORP, "Request for Review and Approval of the Construction Authorization Request for the Hanford Waste Treatment and Immobilization Plant - Analytical Laboratory Facility - Approach to Implement the Integrated Safety Management Plan (ISMP) and Safety Requirements Document (SRD)," dated July 1, 2004.

[26] CCN: 024490, BNI letter from R. F. Naventi to M. K. Barrett, DOE, "Request for Review and Approval of the Partial Construction Authorization Request for the Hanford Waste Treatment and Immobilization Plant," Attachment 6, "Approach to Implement the SRD and ISMP," dated December 10, 2001.

(a) Identify the construction activities, including those that may impact ITS SSCs. This element of the approach is documented in the PSAR Volume VI, Chapter 2, "Facility Description," and Chapter 4, "Important to Safety Structures, Systems, and Components."

(b) Identify the radiological, nuclear, and process regulatory commitments from the SRD and ISMP that apply to the activities identified in Item (a) above.

(c) Identify and develop processes and procedures that will implement the regulatory commitments identified in Item (b) above.

(d) Assess that the plan for performance of construction activities complies with items identified in Item (b) above (i.e., the CAR submittal, integrated with project self-assessments, declaration of readiness, and a DOE readiness inspection, will ensure acceptability and compliance of the activities with the SRD and ISMP).

The Contractor completed an assessment of the plan to perform construction activities in compliance with the radiological, nuclear, and process regulatory commitments and transmitted it to ORP in August 2002.[27] The Contractor also performed a specific assessment on readiness to proceed with construction of the analytical laboratory, report 24590-LAB-MAR-ENG-04-001, *Management Assessment of Lab Construction Readiness,* which resulted in six open items that required completion prior to start of construction. Two engineering items were identified as prestart actions for full construction: (1) issuing a Confidence in Design Assessment, and (2) completing the Civil/Structural and Architectural Design Verification Matrix. The design verification matrix work was completed in May 2004[28], and the confidence in design assessment was completed in July 2004.[29]

Four nuclear and process safety items were identified as prestartup for full construction: (1) submittal of the analytical laboratory PSAR to DOE, (2) subsequent approval of the PSAR, (3) approval of ABAR 24590-WTP-SE-ENS-04-011, *Identification of Natural Phenomena Hazards (NPH) Standards for the Safety Class (SC); Safety Significant (SS); Additional Protection Class (APC) Classification Scheme*, and (4) approval of ABAR 24590-WTP-SE-ENS-04-032, *Revision to Safety Requirements Document (SRD) for Safety Significant Structures, Systems, and Components (SSCs)*. Items (1), (3), and (4)

[27] CCN: 039965, BNI letter from R. F. Naventi to R. J. Schepens, ORP, "Hanford Tank Waste Treatment and Immobilization Plant Critical Decision 3c Declaration of Readiness," dated August 28, 2002.
[28] 24590-LAB-DVM-CSA-04-001, Rev. 0, issued May 6, 2004.
[29] CCN: 088028, BNI Internal Memo from P. Keuhlen to J. Betts, "Confidence Assessment of Analytical Laboratory (Lab) Design in Support of the Construction Authorization Request for the Hanford Waste Treatment and Immobilization Plant," dated July 1, 2004.

have been completed[30,31,32] while Item 2 will be completed with issuance of this SER. The reviewers observed selected aspects of the Contractor management assessment of readiness to commence laboratory construction. The observations included preparatory meetings prior to the management assessment to determine the assessment scope, attendance at meetings during the assessment to understand developing issues, thorough critique of the draft report, and review of the final report. No concerns were identified with the assessment, which had adequate scope to ensure that the Contractor was ready to begin construction of the facility. Based on these observations, the reviewers concluded that the Contractor was ready to begin construction, once a construction authorization was issued.[33]

The Contractor's approach ensures that the construction activities will be implemented consistent with the program described in the ISMP and that the applicable requirements of the ISMP and SRD are met as required by RL/REG-99-05, Sections G.3.3 and H.3.3, both entitled "Regulatory Acceptance Criteria."

2. The ISMP was significantly modified in June 2003. The current ISMP provides a top-level description of the activities of the WTP Project to integrate the radiological, nuclear, and process safety practices and programs with engineering, operations, safety, and quality principles for design, construction, and commissioning of the WTP facility. As such, the ISMP serves as a roadmap document that summarizes the Contractor's ISM approach for activities supporting radiological, nuclear, and process safety and no longer contains requirements. Most of the requirements previously contained in the ISMP have been incorporated into the SRD and the facility-specific PSARs. The requirement that "the safety-related activities will be conducted according to the approved ISMP" was verified to have been met by the existing WTP Project procedures. One new procedure (24590-WTP-3DP-G04T-00905, *Determination of Quality Levels*) was issued to cover the new safety class, SS, and APC safety classifications.

3. The reviewers found that the analytical laboratory PSAR complied with the approved SRD. Specific SRD safety criteria were identified in the PSAR as applicable to the design. The identified safety criteria were consistent with the most recent revision of the SRD, 24590-WTP-SRD-ESH-01-001-02, Safety Requirements Document Volume II. During the review, two changes were made to the SRD that impacted the analytical laboratory PSAR. These are discussed under Item 4 below.

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[30] CCN: 087896, BNI letter from J. P. Henschel to R. J. Schepens, ORP, "Request for Review and Approval of the Construction Authorization Request for the Hanford Waste Treatment and Immobilization Plant - Analytical Laboratory Facility," dated June 2, 2004

[31] 04-WTP-116, ORP letter from R. J. Schepens to J. P. Henschel, BNI, "Approval of BNI ABAR 24590-WTP-SE-ENS-04-011, Revision 0, 'Identification of Natural Phenomena Hazards (NPH) Standards for the Safety Class (SC); Safety Significant (SS); Additional Protection Class (APC) Classification Scheme,'" dated June 18, 2004.

[32] 04-WTP-088, ORP letter from R. J. Schepens to J. P. Henschel, BNI, "Approval of Authorization Basis Amendment Request 24590-WTP-SE-ENS-04-032, Rev. 0, 'Revision to Safety Requirements Document (SRD) for Safety Significant Structures, Systems, and Components (SSCs),'" dated May 5, 2004.

[33] Inspection Note A04AMWTP-RPPWTP-003-10, March 1 - June 30, 2004, dated July 20, 2004.

4. The Contractor used the approved process described in RL/REG-97-13, Office of River Pro*tection Position on Contractor-Initiated Changes to the Authorization Basis*, to make changes to the authorization basis. Revisions to the authorization basis that the Contractor can make to the facility design, operations, or administrative controls are done through the ABAR[34] process, which requires ORP approval prior to implementation. Changes of minor safety significance can be made without an ABAR and do not require ORP approval.

   The last change to the ISMP was made in June 2003 when it was changed to a roadmap document that summarized the Contractor's approach to ISM.

   The SRD has been changed six times since the updated WTP PSAR was reviewed and approved in January 2004. All changes were made using the approved process described in RL/REG-97-13. The most significant changes to the SRD that impacted the analytical laboratory PSAR were ABAR 24590-WTP-SE-ENS-04-032 and -011. ABAR 24590-WTP-SE-ENS-04-032 added the phrase "safety significant" wherever the SRD identified applicable "safety design significant" designations to implement the laboratory facility SSC classification scheme that is based on DOE-STD-3009-94. ORP approved the ABAR in May 2004.[35] ABAR 24590-WTP-SE-ENS-04-011 identified the NPH standards to be used for safety class, SS, and APC equipment. Both SS and APC equipment were identified in the analytical laboratory PSAR. This ABAR was approved in June 2004.[36]

5. Based on review of numerous ABARs the Contractor submitted to ORP for review and the Contractor's safety evaluations since the SER was issued for construction of the PT, HLW, LAW, and BOF, ORP determined that the Contractor is generally following the requirements in SRD Appendix A for maintaining the SRD and Appendix I[37] for changes to the authorization basis. Previous assessments of the Contractor's authorization basis maintenance program in January 2003 and September 2003[38] identified occasional, but persistent, failure to implement the change process. However, enough improvement was noted in the September 2003 assessment that a reduction in some of the controls described in RL/REG-97-13 was warranted.

[34] These changes are made using RL/REG-97-13, Section 3.0, "Position," Items 3.5(a) and 3.5(b).
[35] 04-WTP-088, ORP letter from R. J. Schepens to J. P. Henschel, BNI, "Approval of Authorization Basis Amendment Request (ABAR) 24590-WTP-SE-ENS-04-032, Revision 0, 'Revisions to the Safety Requirements Document (SRD) for Safety Significant Structures, Systems, and Components (SSCs),'" dated May 5, 2004.
[36] 04-WTP-116, ORP letter from R. J. Schepens to J. P. Henschel, BNI, "Approval of BNI ABAR 24590-WTP-SE-ENS-04-011, Revision 0, 'Identification of Natural Phenomena Hazards (NPH) Standards for the Safety Class (SC); Safety Significant (SS); Additional Protection Class (APC) Classification Scheme,'" dated June 18, 2004.
[37] Appendix A, "Implementing Standard for Safety Standards and Requirements Identification," and Appendix I, "Ad Hoc Implementing Standard for Project Integrated Safety Management Approach."
[38] 03-OSR-0033, ORP letter from R. J. Schepens to J. P. Henschel, BNI, "Authorization Basis (AB) Management Assessment Report, A-03-OSR-RPPWTP-007, Conducted January 6, 2003, Through January 15, 2003," dated February 7, 2003; 03-OSR-0361, ORP letter from R. J. Schepens to J. P. Henschel, BNI, "Authorization Basis (AB) Management Assessment Report, A-03-OSR-RPPWTP-018, Conducted September 15 Through September 24, 2003," dated October 16, 2003.

6. The SRD standard that applies to selecting implementing standards for each safety criterion in the SRD is Appendix A, "Implementing Standard for Safety Standards and Requirements Identification." For standards selection, the Contractor is required to follow the ISM process described in SRD Appendix A. A May 2003 ORP SRD standards selection assessment[39] concluded that Contractor procedures for selecting standards via the ISM process were adequate for design and authorization basis changes.

For implementing specific SRD standards, a July 2003 ORP assessment[40] concluded breakdowns had occurred in the Contractor's implementation of SRD codes and standards. The Contractor responded[41] with proposed actions and ORP accepted the actions with the caveat that the Contractor submit an ABAR to either add the appropriate pump standards to the SRD or tailor the requirements of American Society of Mechanical Engineers (ASME) Standard B31.3, "Process Piping," and ASME Section VIII to include the pressure-retaining boundaries of pumps and similar components. The additional or tailored standards were to be determined according to the Contractor's ISM process. The Contractor submitted[42] an ABAR that made the appropriate change to the SRD, and ORP accepted[43] the ABAR. A subsequent May 2004 ORP SRD standards implementation assessment[44] concluded the Contractor had implemented the SRD-specified electrical and mechanical design standards at the various stages of the design for the codes and standards and ITS equipment reviewed. During the assessment, ORP randomly selected piping stress analysis calculations for review to follow up on previous assessment findings related to the inappropriate reference to ASME III code requirements for equipment to retain their hazardous inventory rather than the ASME B31.3 required by SRD safety criteria implementing codes and standards. The review determined the calculations correctly invoked ASME B31.3 requirements according to the SRD.

One ABAR submitted for approval potentially impacted the selection of implementing codes and standards for the analytical laboratory. ABAR 24590-WTP-SE-ENS-03-771, *Clarification of Requirements to Identify RRC Implementing Codes and Standards in the SRD*, requested a change that would allow implementing codes and standards to be unspecified for RRC SSCs rather than using the implementing codes and standards

[39] 03-OSR-0245, ORP letter from R. J. Schepens to J. P. Henschel, BNI, "Standards Selection Process Inspection Report A-03-OSR-RPPWTP-013," dated July 14, 2003.
[40] 03-OSR-0301, ORP letter from R. J. Schepens to J. P. Henschel, BNI, "Safety Requirements Document (SRD) Implementation Inspection Report A-03-OSR-RPPWTP-016," dated September 4, 2003.
[41] CCN-073356, BNI letter from J. P. Henschel to R. J. Schepens, ORP, "Bechtel National, Inc.'s Response to Inspection Report A-03-OSR-RPPWTP-016," dated October 9, 2003.
[42] CCN-078323, BNI letter from J. P. Henschel to R. J. Schepens, ORP, "Re-Transmittal for Approval: Authorization Basis Amendment Request 24590-WTP-SE-ENS-03-368, Revision 1, Addition of Tailored Requirements (API-610-1995 and API-685-2000) to SRD Safety Criterion 4.2-2," dated February 5, 2004.
[43] 04-WTP-027, ORP letter from R. J. Schepens to J. P. Henschel, BNI, "Approval of Bechtel National, Inc. (BNI) Authorization Basis Amendment Request (ABAR) 24590-WTP-SE-ENS-03-368, Revision 1, Addition of Tailored Requirements (API-610-1995 and API-685-2000) to Safety Requirements Document (SRD) Safety Criterion 4.2-2," dated March 4, 2004.
[44] 04-ESQ-047, ORP letter from R. J. Schepens to J. P. Henschel, BNI, "Safety Requirements Document (SRD) Design Standards Implementation Assessment Report, A-04-ESQ-RPPWTP-007," dated June 18, 2004.

already specified in specific SRD safety criteria. ORP approved the change[45] for implementing codes and standards for design of RRC and APC SSCs because the change provided that implementing codes and standards for *design* will be selected using the project ISM standards selection process. However, ORP will still approve implementing codes and standards for *programmatic* safety criteria that apply broadly to ITS SSCs, such as Safety Criterion 4.0-1 for configuration management or Safety Criterion 7.3-1 for QA. Because the analytical laboratory uses the APC SSC designation rather than RRC, this change applied to the analytical laboratory PSAR.

7. Independent review and assessment of changes to the SRD are described in Appendix A, Section 11.0, "Maintenance of the SRD," and Appendix I, Section 4.0, "Internal Safety Oversight." These sections specify that proposed changes to the SRD be evaluated for impact on safety and compliance with regulations and the authorization basis. These changes are then reviewed and approved using subject matter experts as defined in DOE/RL-96-0004, *Process for Establishing a Set of Radiological, Nuclear, and Process Safety Standards and Requirements for the RPP Waste Treatment Plant Contractor.* All proposed ABAR changes to the SRD contain a signoff sheet from required reviewers identified for the particular ABAR, such as the QA Manager, the Engineering Manager, and the Environmental and Nuclear Safety Manager. The reviewers determined that this met the requirement for independent review of changes to the SRD.

4.1.3 Conclusions

The reviewers concluded that the Contractor's proposed changes to the SRD and ISMP were acceptable and that design of the analytical laboratory complied with the design related part of the SRD.

4.2 Closure of Open Items from Previous Reviews

The purpose of this review was to determine whether the Contractor submitted sufficient design data and other information to support the closure of open items from previous ORP safety reviews.

4.2.1 Requirements

As noted in the SER[46] for authorization of full construction for the PT, LAW, HLW, and BOF, six items remained open from the ISAR review and Topical Meetings (see Table 1). Three of the items were to be closed with submittal of the PSAR for the analytical laboratory, and three were

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[45] 03-OSR-0445, ORP letter from R. J. Schepens to J. P. Henschel, BNI, "Modification of Approval of Authorization Basis Amendment Request (ABAR) 24590-WTP-SE-ENS-03-771, Revision 0, 'Safety Requirements Document (SRD), Clarification of Requirements to Identify RRC Implementing Codes and Standards,'" dated December 15, 2003.

[46] ORP/OSR-2002-18, Section 6.7, "Closure of Open Items from Previous Reviews."

Table 1. Open Items from ISAR Review and Topical Meetings

Source	Issue Number	Issue	Closure Commitment
ISAR	C-17	Establishment of an "at the controls" area in the main control room, or of limiting access to the main control room only to authorized personnel (Section 3.9.3.11, "Operational Practices")	FSAR – Applicable to all facilities with control rooms
ISAR	C-27	Inconsistencies between information provided in the Unreviewed Safety Question Plan outline and SRD Safety Criterion 7.4-4	FSAR – Applicable to all facilities
ISAR	Q-011	Sample results	PSAR for the analytical laboratory
ISAR	Q-012	Details regarding sample isolation and shielding as well as methods, controls, equipment, and worker protection	PSAR for the analytical laboratory
Topical Meeting	TMAI-18-12	Discuss ALARA and Reliability, Availability, Maintainability and Inspectability (RAMI) used in the melter subsystems	FSAR – Applicable to LAW and HLW facilities
Topical Meeting	TMAI-7	Specify laboratory data quality requirements	PSAR for the analytical laboratory

to be completed as part of the FSAR process. The review of the analytical laboratory PSAR addressed closure of the three open items due at this time.

4.2.2 Evaluation

The evaluation of the information for each open item is summarized below.

Item ISAR Q-011 – This ISAR open item asked why sample results were not listed in Table 3-4, "Safety Management Records," of the ISAR. The Contractor responded that samples were included in multiple entries in Table 3-4 (e.g., startup test results; material balance, inventory, transfer, and disposal records; and environmental release and monitoring records). While the Contractor's response was acceptable, it dealt with the records associated with the samples as opposed to the sample results themselves, and therefore the issue remained open for future discussions between the Contractor and ORP.

Since the ISAR was evaluated, several events relating to this issue have taken place between the Contractor and ORP. In March 2003, the ISAR was removed as an authorization basis document[47] because the fundamental aspects of design have been incorporated into the PSAR. Also in May 2003, ORP approved an ABAR[48] that made major revisions to the ISMP, including deletion of Table 8-1, "Safety Management Records." This was acceptable because Policies Q-06.1, "Document Control," and Q-17.1, "Quality Assurance Records," in 24590-WTP-QAM-

[47] 03-OSR-0086, ORP letter from R. J. Schepens to R. F. Naventi, BNI, "Removal of Documents from the Authorization Basis," dated March 11, 2003.
[48] 03-OSR-0178, ORP letter from R. J. Schepens to R. F. Naventi, BNI, "Conditional Approval of Bechtel National, Inc. (BNI) Authorization Basis Amendment Request (ABAR) 24590-WTP-ABAR-ENS-02-001," dated May 28, 2003.

QA-01-001, *Quality Assurance Manual*, identified the safety management records. Therefore, the results from any analytical samples will be controlled and maintained as quality records using approved quality control procedures. This item is considered closed.

Item ISAR Q-012 – This ISAR open item asked what the isolation and shielding requirements were for process samples, sampling equipment, and penetrations to the process equipment. The Contractor responded that the facility contains an extensive sampling system and that the system uses both automatic and manual sampling stations for sampling the process in enclosed cabinets throughout the facility. The Contractor further stated that the details regarding isolation and shielding of the sampling system, as well as methods, controls, equipment, and worker protection, would be further developed during Part B of the design. The reviewers found the response acceptable subject to the design being finalized at a later time.

PSAR Volume VI, Section 2.5.10, "Autosampling System," generally described the autosampling system (ASX), including the use of shielding in the hotcell receipt area to protect the workers from exposure. Section 3.3.3.3, "Autosampling System," described the hazards associated with the ASX, including those from direct radiation exposure and loss of contamination control. These were further discussed in Sections 3.3.6.1.1, "Worker Exposure Due to a Mis-Transfer Event," and 3.3.6.2, "Loss of Contamination Control."

The ASXs are also described in the facility-specific PSARs. PSAR Volume II, Section 2.4.20, "Autosampling," described the process used in the PT facility for sampling. PSAR Volume IV, Section 2.4.21, "Autosampling," described the process for sampling in the HLW facility. In addition, the Contractor generated extensive drawings (e.g., sampling cabinets, pneumatic transfer systems, and control systems), descriptions, and engineering specifications to procure the necessary ASXs for the WTP facilities. A contract was let in June 2004 to BNFL for the design and construction of the ASX. This item is considered closed.

Topical Meeting Item TMAI-7 – This ISAR open item dealt with specifying laboratory data quality requirements, particularly as they applied to the research and testing program being performed at the time. The lack of procedures to define and specify data quality requirements was identified during a design process inspection performed in January 2000.[49] The inspection identified the following inspection followup item (IR-00-001-04-IFI):[50] "Lack of procedures or implementation of QAPIP [Quality Assurance Program and Implementation Plan] requirements to define and specify data quality requirements." This open item was also tracked as a Topical Meeting Open Issue from Topical Meeting 11. In April 2000,[51] BNFL provided a response to IR-00-001-04-IFI. However, before the action was closed, the BNFL contract was terminated. The succeeding Contractor, BNI, reported that BNFL had not implemented the corrective actions prior to contract closure and committed to provide a revised corrective action plan.[52] A revised

[49] 00-RU-0210, RU letter from D. C. Gibbs to M. J. Bullock, BNFL, "Design Basis Inspection Report, IR-00-001," dated February 8, 2000.
[50] Inspection Report IR-00-001, *Design Basis Inspection Report*.
[51] CCN: 011412, BNFL letter from A. J. Dobson to D. C. Gibbs, DOE, "Response to Design Process Inspection Report, IR-00-001," dated April 3, 2000.
[52] CCN: 020157, BNI letter from R. F. Naventi to W. J. Taylor, ORP, "Bechtel National, Inc. Commitment to Provide Revised Corrective Action Plan for Inspection Follow-up Item IR-00-001-04-IFI," dated June 7, 2001.

corrective action plan was submitted to ORP in August 2001.[53] ORP subsequently accepted the action plan in August 2001,[54] stating that the corrective action plan commitments, if properly implemented, should address the inspection followup item. This item is considered closed.

4.2.3 Conclusions

The reviewers concluded that the three open items from the ISAR and Topical Meetings that were to be closed with the analytical laboratory PSAR had been acceptably closed.

4.3 Conformance with Facility Risk Goals

The purpose of this review was to determine whether the PSAR demonstrated that the analytical laboratory facility design conforms to the facility risk goals.

4.3.1 Requirements

DOE/RL-96-0006,[55] contains two general safety objectives that limit the risk of fatality to offsite populations (these are also found in SRD Safety Criteria 1.0-2 and 1.0-3):

1. **Accident risk goal** – The risk to an average individual within 1 mile of the RPP-WTP Controlled Area Boundary of prompt fatalities that might result from an accident shall not exceed 0.1% of the sum of prompt fatality risks resulting from other accidents to which members of the U.S. population generally are exposed. The accident risk goal is considered numerically equivalent to a prompt fatality risk of 4×10^{-7} per year.

2. **Operations risk goal** – The risk to the public and workers within 16 km (10 miles) of the RPP-WTP of cancer fatalities that might result from RPP-WTP operations shall not exceed 0.1% of the sum of cancer fatality risks to which members of the U.S. population generally are exposed. The operations risk goal is numerically equivalent to a latent cancer fatality risk of 2×10^{-6} per year.

The facility risk analysis in the analytical laboratory PSAR was acceptable if it demonstrated that, when considered together with the other parts of the WTP facility, the design adequately conforms to the general safety objectives addressing facility risk.

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[53] CCN: 021705, BNI letter from R. F. Naventi to W. J. Taylor, ORP, "Bechtel National, Inc. Revised (Second Submittal) Corrective Action Plan for Inspection Follow-up Item IR-00-001-04-IFI," dated August 7, 2001.
[54] 01-OSR-0324, ORP letter from R. C. Barr to R. F. Naventi, BNI, "Office of Safety Regulation (OSR) Response to Bechtel National, Inc. Revised Corrective Action Plan for Inspection Follow-up Item IR-00-001-04-IFI," dated August 20, 2001.
[55] *Top-Level Radiological, Nuclear, And Process Safety Standards And Principles For The RPP Waste Treatment Plant Contractor*, Section 3.1, "General Safety Objectives."

4.3.2 Evaluation

To assess conformance to the risk goals, the reviewers evaluated the analysis of laboratory facility risk in PSAR Volume VI, Section 3.6, "Adherence to Risk Goals and Results." Section 3.6 references PSAR Volume I, Section 3.8, "Results from the Operational Risk Assessment and Conformance to Risk Goals," which summarized the results of a preliminary assessment of analytical laboratory risk found in report 24590-WTP-RPT-ENS-03-007, *WTP Operations Risk Analysis (ORA) - Risk Goal Confirmation*. This preliminary risk assessment, based on design information available as of April 2003, found analytical laboratory risk (~0.03% of the risk goal) to be a small contributor to the overall facility risk estimate (~9% of the risk goal). Because the preliminary assessment was not updated for the analytical laboratory PSAR submittal, the reviewers focused on evaluating the consistency of the preliminary risk estimate with the current design and information submitted in the analytical laboratory PSAR and on determining whether the preliminary risk estimate satisfied the requirements. Specific areas of review included the following:

1. Comparison of the facility design and process description found in the analytical laboratory PSAR, Chapter 2, "Facility Description" with facility design and process assumptions made in the risk analysis models used to quantify the analytical laboratory portion of the ORA

2. Comparison of the SIPD entries in the analytical laboratory PSAR, Appendix A, "Analytical Laboratory Hazards Assessment Report; Standards Identification Process Database Output," with the SIPD entries downloaded into the ORA model

3. Comparison of the accident analysis used in the analytical laboratory PSAR with the accident analysis in the preliminary estimate of the ORA.

The preliminary risk estimate provided with PSAR Volume I represented the first analytical laboratory risk information the Contractor submitted. However, the analytical laboratory portion of the risk assessment was not considered within the scope of the WTP PSAR (Revision 1 of Volumes I-V of the PSAR) review effort and was not reviewed at the time of WTP PSAR submission. The analytical laboratory risk estimate was evaluated as part of the current analytical laboratory PSAR review to determine its acceptability for the current analytical laboratory design.

The overall analysis approach used in the analytical laboratory risk assessment was found to be acceptable and similar to the approach used for the other parts of the WTP facility risk. At a high level, that approach consisted of several major steps:

1. Downloading the hazard analysis entries in the analytical laboratory SIPD (Appendix A of the PSAR) into an Excel spreadsheet file

2. Developing the SIPD entries into accident progression analysis represented by simplified event trees

3. Linking the accident progression events to a master database containing initiator frequencies, failure frequencies, or probabilities based on generic data or detailed system failure models and accident consequence estimates.

Although the ORA risk estimate is more than a year old, the reviewers found that most of the current analytical laboratory design features, safety systems, and processes had been incorporated into the earlier ORA analysis. For example, the C3 and C5 ventilation systems were incorporated as safety systems throughout the ORA accident analysis as well as all major categories of hazards found in the current analytical laboratory hazard analysis.

The reviewers questioned (Question AL-PSAR-008) the applicability of unmitigated consequence calculations incorporated into the ORA accident sequences. The consequence values used in the ORA were inconsistent with the consequences in the severity level calculation (24590-LAB-Z0C-W14T-00003) submitted with the analytical laboratory PSAR. The unmitigated accident consequences form the basis for the consequence analysis of all accident sequences in the ORA. The reviewers found that unmitigated consequences used in the ORA preliminary estimate were as much as a factor of 50 smaller than the consequences for the same accident in the severity level calculation submitted with the analytical laboratory PSAR. In response to Question AL-PSAR-008, the Contractor provided additional information[56] showing the effect on the preliminary risk estimate of updating only the unmitigated consequences. The results indicate that the changes in consequence values increased the overall risk estimate when applied to the preliminary risk estimate. However, the exact numerical value of the increase in risk was unclear because it depended on how accident sequences in the ORA are modified as a result of other issues discussed below. In response to Question AL-PSAR-008, the Contractor committed to complete the following:

1. Develop a written process within 60 days of the laboratory PSAR approval to periodically assess the performance of barriers, engineered safety features, and administrative controls as discussed in ORP letter 03-AMWTP-025.[57]

2. As a result of the known and anticipated changes in the WTP that have occurred or will occur prior to the next PSAR update, requantify the ORA and submit the results of the requantification prior to the next revision of the laboratory PSAR in December, 2005. If, after development of the process in Item 1, an assessment determines that requantification is not likely to conclude that the risk goals for the WTP may be exceeded, BNI may request a delay in the requantification.

3. Provide a schedule for requantification that commits to requantify the lab risk as the first phase of the overall requantification effort. The schedule will be provided to ORP within 60 days of ORP approval of the laboratory PSAR.

[56] CCN 083670, Internal BNI Memo from N. Hunt to B. T. Allen, "Requantification of the Lab Risk Estimates to Reflect Changes in the Severity Level Dose Estimates," dated April 3, 2004.
[57] 03-AMWTP-025, Letter R. J. Schepens to R. F. Naventi, BNI, "Risk Goal Improvements", dated March 26, 2003.

This was acceptable because it makes a commitment to address the question in a requantification of the laboratory risk estimate before submittal of the next revision of the analytical laboratory PSAR in 2005. This commitment is considered acceptable because it will allow sufficient time to perform further analysis or consider mitigative actions before approval of the final analytical laboratory design if unexpected problems arise in the laboratory risk estimate. In addition, the response makes a commitment to requantify the entire ORA (including the laboratory portion) and to develop a process for periodic assessment of the impact to the ORA of ongoing design changes.

The reviewers also questioned (Question AL-PSAR-022) the consistency between the draft version of the analytical laboratory SIPD used in the ORA and the current version of SIPD in PSAR Appendix A, "Analytical Laboratory Hazards Assessment Report; Standards Identification Process Database Output." Because all accident sequences modeled in the ORA were based on SIPD entries, changes to SIPD since the April 2003 could impact the analytical laboratory risk estimate. A comparison of old and new SIPD entries during the review showed significant differences between the two databases. It was unclear whether the net effect of changes to SIPD would increase or decrease the risk estimate. In response to Question AL-PSAR-022, the Contractor committed to revise the analytical laboratory risk estimate in the ORA as discussed above. The reviewers found this acceptable.

The reviewers also questioned (Question AL-PSAR-025) the consistency of the analysis of the confinement system in the ORA with that in the analytical laboratory PSAR. The reviewers found that the ORA credited the exhaust HEPA filtration function of the system for mitigating many accidents in which the fans were not running (e.g., loss of offsite power and hotcell fires). However, the PSAR did not credit the exhaust HEPA filtration function for these accidents but used a much smaller decontamination factor based on analysis of unfiltered leak paths out of the hotcell area. Revising the confinement analysis in the ORA could significantly impact (an order of magnitude or more) the accident sequences involved. In response to Question AL-PSAR-025, the Contractor committed to revise the analytical laboratory risk estimate in the ORA as discussed above. The reviewers found this acceptable.

The reviewers also questioned (Question AL-PSAR-026) the consistency of certain SSC reliability assumptions made in the ORA with the design information presented in the analytical laboratory PSAR. For example, the fire suppression system was credited in the ORA for preventing hotcell fire releases with a failure rate of 0.005/demand based on the assumption that the fire suppression system would be designed with the reliability of a safety integrity level (SIL) SIL-2 safety instrumented system as defined in standard ANSI/ISA-S84.01-1996 (S84.01), *Application of Safety Instrumented Systems for the Process Industries*. However, the reviewers determined that, based on the current design requirements for the fire suppression system in the PSAR, this failure rate was roughly a factor of 10 too low. Another concern was the automated sampling system, which was also assumed to have an SIL-2 reliability in the ORA, but for which the PSAR did not specify any design information. Based on a random review of individual SSCs, the reviewers determined that a systematic review of the ORA SSC reliability values should be performed but has not been done by the Contractor. In response to Question AL-PSAR-026, the Contractor committed to revise the analytical laboratory risk estimate in the ORA as discussed above.

4.3.3 Conclusions

The reviewers found the Contractor's analytical laboratory risk analysis to be acceptable subject to the Contractor completing the actions described below.

Conditions of Acceptance – BNI must complete the following by the date or milestone indicated:

1. Revise the analytical laboratory ORA as follows (see Section 4.3.2):

   (a) Develop a written process within 60 days of the laboratory PSAR approval to periodically assess the performance of barriers, engineered safety features and administrative controls as discussed in ORP letter 03-AMWTP-025.

   (b) As a result of the known and anticipated changes in the WTP that have occurred or will occur prior to the next PSAR update, requantify the ORA and submit the results of the requantification prior to the next revision of the laboratory PSAR in December, 2005. If, after development of the process in Item 1, an assessment determines that requantification is not likely to conclude that the risk goals for the WTP may be exceeded, BNI may request a delay in the requantification.

   (c) Provide a schedule for requantification that commits to requantify the lab risk as the first phase of the overall requantification effort. The schedule will be provided to ORP within 60 days of ORP approval of the laboratory PSAR.

5.0 RECOMMENDATIONS

Construction authorization was requested for the full analytical laboratory. Based on the detailed review performed by the OSR between March 1, 2004 and July 29, 2004, the ORP concluded that construction of the full analytical laboratory should be approved, subject to the COAs listed in Appendix B.

6.0 REFERENCES

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7.0 LIST OF TERMS

ABAR	Authorization Basis Amendment Request
AIChE	American Institute of Chemical Engineers
APC	additional protection class
ARM	area radiation monitor
ASX	autosampling system
BNI	Bechtel National, Inc.
BOF	balance of facility
CAR	Construction Authorization Request
CAM	continuous air monitor
COA	condition of acceptance
CSD	control strategy development
CSE	control strategy elements
DBE	design basis event
DOE	U.S. Department of Energy
FHA	Fire Hazard Analysis
FSAR	Final Safety Analysis Report
HLW	high-level waste
ISAR	Initial Safety Analysis Report

ISM	integrated safety management
ISMP	Integrated Safety Management Plan
ITS	important-to-safety
LAW	low-activity waste
NPH	natural phenomena hazard
NRC	U.S. Nuclear Regulatory Commission
ORA	operations risk analysis
ORP	Office of River Protection
PC	performance category
PCAR	Preliminary Construction Authorization Request
PFHA	Preliminary Fire Hazards Analysis
PSAR	Preliminary Safety Analysis Report
psf	pounds per square foot
PT	pretreatment
QA	quality assurance
RPP	River Protection Project
RRC	risk reduction class
SC	seismic category
SCR	safety case requirements
SER	safety evaluation report
SIL	safety integrity level
SIPD	Standards Identification Process Database
SL	severity level
SRD	Safety Requirements Document
SS	safety significant
SSC	system, structure, and component
TSR	technical safety requirement
UBC	Uniform Building Code
WTP	Waste Treatment and Immobilization Plant

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Appendix A - Review Team

Table A.1 summarizes the review team's composition and expertise for review of BNI's analytical laboratory CAR submittal.

Table A.1. Review Team Membership Education and Experience

Review Team Member	Education and Experience
Bruce Carpenter	B.S., Architectural Engineering, University of Colorado; M.S., Civil Engineering, Structures, Stanford University. Registered professional engineer with over 15 years' experience on commercial and DOE projects. Expertise in structural engineering and seismic design for structural steel and reinforced concrete.
Ko Chen	B.S., Chemical Engineering, National Taiwan University; Ph.D., Mechanical Engineering, University of California Berkeley. Licensed mechanical engineer. More than 20 years' experience in nuclear safety, fluid mechanics, mass transfer, and heat transfer.
Dean Davis	B.S., University of Montana. Certified professional engineer in fire protection. Over 45 years' experience in fire protection, including 14 years with DOE Richland Operations, and 15 years as Chief, Fire Protection, U.S. Army, Europe.
Robert Griffith	B.S., Mechanical Engineering, University of Arizona; M.S., Mechanical Engineering, Stanford University. Registered professional engineer. More than 26 years' experience in systems engineering, licensing support, safety engineering, and environmental qualification at DOE, commercial power plants, and the Savannah River Site.
Tracy Ikenberry	B.A., Biology, McPherson College; M.S., Health Physics, Colorado State University. Certified health physicist. Over 20 years' experience at DOE sites in environmental and occupational radiation protection, including radiological hazard assessment.
James Leivo	B.S., Electrical Engineering, Carnegie-Mellon University. Registered professional engineer. Over 30 years' experience in the nuclear power industry and related energy systems, including instrumentation, control, and electrical and computer systems for nuclear power plants and DOE facilities. Has provided independent consulting services to U.S. Nuclear Regulatory Commission (NRC) for operating, pre-operating, and advanced reactor plants.
Ron Lerch	B.A., Chemistry, Pacific Lutheran University; Ph.D., Inorganic Chemistry, Oregon State University. More than 30 years' experience in nuclear waste management, nuclear technology development, nuclear fuel reprocessing, environmental cleanup, and project management; 2 years as Deputy Manager of Hanford tank farms.
Chung-King Liu	B.S., Zoology, Fu-Jen Catholic University (Taiwan); M.S., Chemistry, Kansas State College - Pittsburgh; Ph.D., Nuclear Radiochemistry, University of Arkansas. NQA-1 lead nuclear auditor. Over 23 years' experience in nuclear waste management, radiochemistry laboratory management, and environmental cleanup. Has expertise in the areas of chemical process safety, nuclear process safety, and health physics.

Review Team Member	Education and Experience
Surya Maruvada	Master of Engineering, Electrical Power Engineering/Indian Institute of Science. Licensed professional engineer. Over 30 years' experience in nuclear safety and hazard analyses; probabilistic risk assessment; reliability, availability, and maintainability analyses; and electrical power and control systems.
Milon Meyer	B.S., Mechanical Engineering, University of Iowa. Over 35 years' experience in structural analysis, equipment qualification, and finite element analysis related to nuclear, gas turbine, rockets, and aerospace.
Lew Miller	B.S., Physics, Massachusetts Institute of Technology; M.S., Nuclear Engineering Science, University of California, Berkeley. OSR Safety and Standards Review Official. Certified license examiner, senior resident inspector. More than 31 years' experience with the nuclear Navy, the NRC, and DOE. Expertise in nuclear safety oversight, safety analysis reviews assessments, and incident investigations.
Robert Nelson	B.S., M.S., and Ph.D., Radiation Biophysics, University of Kansas. Over 35 years' experience with the U.S. Department of Defense, DOE, NRC, and NASA in areas of radiation protection, nuclear safety, criticality safety, accident analysis, probabilistic risk assessment, space nuclear power, space launch safety, reactor operations, assessments, readiness reviews, and licensing.
Joe Panchison	B.S., Mechanical Engineering, Drexel University. Licensed professional engineer. Over 23 years' experience in mechanical engineering design, thermal hydraulic analysis, fluid systems analysis, HVAC, power piping, and nuclear component codes and standards. Direct experience in plant modifications and configuration management.
Jeanie Polehn	B.S., Nuclear Engineering Technology, Oregon State University; M.S., Health Physics, Georgia Institute of Technology. Certified health physicist. Registered environmental manager. More than 20 years' experience in radiation protection including occupational, environmental, and emergency response at commercial power plants and with DOE.
John Treadwell	B.S., Civil Engineering, University of Washington; M.S. Civil Engineering, University of Missouri. Licensed professional engineer. Over 34 years' design and construction experience on major federal projects. Served as project engineer, project manager, and program manager on DOE and DOD projects including civil works facilities, military works, uranium enrichment, WIP, and other waste repository programs. Senior civil, structural and architectural SSO for WTP.
Brian Vonderfecht	Ph. D., Nuclear Physics, Washington University. Over 11 years' nuclear experience in nuclear criticality safety, accident analysis, probabilistic risk analysis, radiation shielding, and nuclear physics. Expertise in thermal-hydraulics, heat-transfer, diffusion, and chemical or thermal explosions.

Appendix B - Conditions of Acceptance

The COAs for the analytical laboratory PSAR evaluation are shown below by the section in which they were cited.

3.1 Facility Description

Conditions of Acceptance – BNI must complete the following by the date or milestone indicated:

1. Include the requirement to perform periodic leak testing on the C3 decontamination booth isolation damper C5V-YD-6229 to an acceptable leakage level and include the requirement as a TSR in the next PSAR update. (See Section 3.1.2, Item 7.)

2. Include the following definition of passive confinement in the next PSAR update: "The analytical laboratory passive confinement feature is defined as containment of hazardous material achieved by the confinement structure, the C5 exhaust boundary, and the isolation dampers without forced air flow. Leakage from the passive confinement structure is unfiltered and accounted for in the DBE calculation. The term passive confinement, where used in the analytical laboratory PSAR, or associated SIPD, design basis calculations, or associated safety analyses, includes an active element, the C5V-YD-6229 damper, which must fail closed for the confinement boundary assumed in the safety analysis to be accurate. The single failure criterion for this active component was considered and rejected because of the high reliability of the damper. The damper is periodically tested to assure operability, as discussed in Section 5.5.1, "LCO - C3 Decontamination Booth Isolation Damper and Interlock Operability." (See Section 3.1.1, Item 7.)

3. Revise the fire DBE calculation (24590-LAB-Z0C-W14T-00006, *Design Basis Event: Fire in the Laboratory Facility*) and the *Analytical Laboratory Hotcell Fire Hazard Analysis* (24590-LAB-U1C-FPW-00001) to have consistent input (e.g., fire loading) assumptions and fire scenarios. Combustible load limits used in these calculations will be protected by operating limits defined in the WTP combustible control program and TSRs, as necessary. The amended calculations will (a) itemize and sum combustibles (fixed and transient) used in each hotcell analysis to confirm the assumptions used in the calculations and (b) show the degree of conservatism in the hotcell FHA analysis by calculating the hypothetical fire load necessary for flashover conditions. This will be done on a schedule mutually agreed to by the Contractor and ORP. (See Section 3.1.2, Item 9.)

3.2 Facility Hazard and Accident Analyses

Conditions of Acceptance – BNI must complete the following by the date or milestone indicated:

1. Include evaluation of interfacility sample transfer events, including transfers from all facilities using the appropriate facility-specific waste streams, with the next update of the PT facility-specific PSAR. (See Section 3.2.2, Item 2.)

2. Revise bullet 5 in PSAR Section 5.5.4.3, "Administrative Controls - Radiation Protection," to include "radioactive material export" to ensure the specific safety functions relative to CSD-UAHL/N0022 and CSD-UAHL/N0064, and the associated SCR-UADM/N0009 are developed into a TSR. This must be accomplished in the next PSAR update. (See Section 3.2.2, Item 8.)

3. Revise the PSARs as follows (see Section 3.2.2, Item 9.):

   (a) For the general information PSAR, revise Chapter 7, "Radiation Protection," to provide sufficient detail on administrative radiological controls to clearly demonstrate that the controls are adequate to limit potential worker exposure as credited. This will be done with the FSAR, consistent with completion of the seven existing radiation protection COAs from the Volume I PSAR review (ORP/OSR-2002-18).

   (b) For the analytical laboratory PSAR, remove references to the Radiation Protection Program as the basis for administrative radiological controls and describe the specific administrative controls required. This will be done in the next PSAR update.

   (c) For the HLW, LAW, and PT PSARs, remove references to the Radiation Protection Program as the basis for operational administrative radiological controls that do not explicitly appear in the Radiation Protection Program; this will be done in the next PSAR update. Also, in the FSAR remove all other Radiation Protection Program references that do not reference a specific control.

4. Incorporate the results of the hotcell fire duration calculation 24590-LAB-U1C-FPW-00001, *Analytical Laboratory Hotcell Fire Hazard Analysis*, and the hotcell construction description contained in the fire integrity evaluation into the next update of the analytical laboratory PFHA. (See Section 3.2.2, Item 9.)

3.3 Facility ITS SSCs

Conditions of Acceptance – BNI must complete the following by the date or milestone indicated:

1. Classify the bottles in which samples are stored in the hotcells as APC. (See Section 3.3.2, Item 1.)

2. Add the following APC items to Table 3A-6 in the next PSAR update: (1) accident monitoring instrumentation; (2) electrical power distribution SSCs, including UPS, that serve APC loads [C5 ventilation fans, Area Radiation Monitors (ARMs), Continuous Air Monitors (CAMs), and accident monitoring instrumentation]; (3) automatic fire suppression system, including fire water system and controls for monitoring and supplying water to the sprinklers; (4) C5 exhaust duct between decon hotcell and C5V-YD-6229 damper; (5) piping to hotcell drain collection vessel (RLD-VSL-00165); (6) automatic transfer system instrumentation to detect sample holdup in ASX; (7) permanent CAMs; (8) permanent ARMs; (9) gamma monitor inside hotcell transfer port; (10) gamma monitor in hotcell transfer drawer; and (11) leak detection equipment in C5 tank cell sump. (See Section 3.3.2, Item 1.)

3. Implement the fire protection system impairment procedure prior to commissioning of the analytical laboratory. (See Section 3.3.2, Item 4.)

4. Describe the accident monitoring instrumentation, its safety classification, and associated variable types, pursuant to the tailored version of IEEE 497-2002, *IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations*, and governed by the ISM process. (See Section 3.3.2, Item 5.)

5. Either specify and procure the C3 decontamination booth isolation damper C5V-YD-6229 to remain functional at the elevated temperature (150^{o}C) or evaluate the maximum temperature at the damper location and protect the damper against the elevated temperature. (See Section 3.3.2, Item 5.)

4.3 Conformance with Facility Risk Goals

Conditions of Acceptance – BNI must complete the following by the date or milestone indicated:

1. Revise the analytical laboratory ORA as follows (see Section 4.3.2):

   (a) Develop a written process within 60 days of the laboratory PSAR approval to periodically assess the performance of barriers, engineered safety features and administrative controls as discussed in ORP letter 03-AMWTP-025.

   (b) As a result of the known and anticipated changes in the WTP that have occurred or will occur prior to the next PSAR update, requantify the ORA and submit the results of the requantification prior to the next revision of the laboratory PSAR in December, 2005. If, after development of the process in Item 1, an assessment determines that requantification is not likely to conclude that the risk goals for the WTP may be exceeded, BNI may request a delay in the requantification.

(c) Provide a schedule for requantification that commits to requantify the lab risk as the first phase of the overall requantification effort. The schedule will be provided to ORP within 60 days of ORP approval of the laboratory PSAR.